AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 9, No. 38. WEEKLY. | NEW YORK, SEPTEMBER 18, 1886. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

COPYRIGHT 1886, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers.

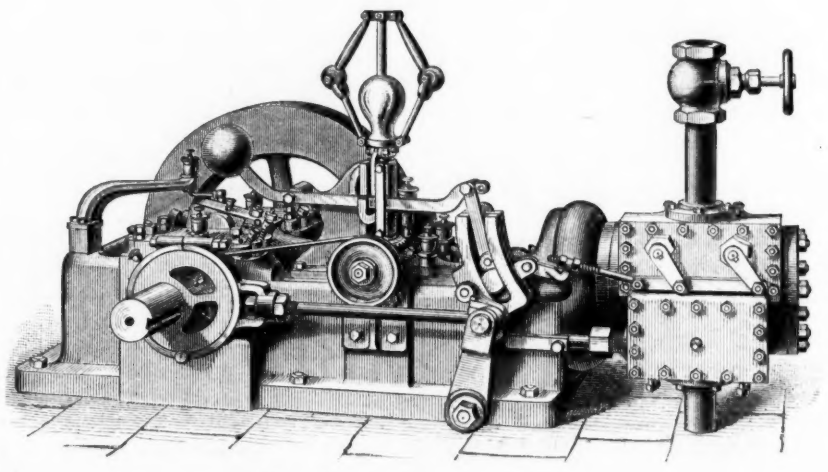
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

The Hough Automatic Cut-off Engine.

The engraving represents an automatic engine, of which the Warner & Hough Machine Company, St. Paul, Minn., has recently begun the manufacture. It is of the type in which separate valves—steam and exhaust—are employed, the construction being such that the exhaust valves are not disturbed by the operation of the governor to vary the point of cut-off.

The eccentric, as will be seen, is connected, through the ordinary rod, with a vibrating lever, which is pivoted to the frame at its lower end. This lever gives a positive and unvarying movement to the exhaust valves. On the upper end of this lever is a pin, upon which is mounted an anti-friction roller, working in a slot in a swinging arm or link, which is pivoted to a suitable standard. The bar which operates the inlet valves is actuated through a suitable rod, link and block by the vibrating lever. The amount of throw of the valve bar and the inlet valves will, of course, be governed by the position of the block with reference to the pivot of the arm. This position is controlled by the governor in a way clearly shown in the engraving, by which means the point of cut-off is varied to suit the load on the engine.

It is claimed for this engine that the positive connection to valves makes any desired speed attainable, and that the peculiar manner of connecting induces smooth working of all parts, including the governor.



THE HOUGH AUTOMATIC ENGINE.

The Lowe Boiler Furnace.

This furnace, the invention of Wm. Lowe, proprietor of the Bridgeport (Conn.) Boiler Works, is designed for use with horizontal tubular, and flue boilers and other externally fired boilers. The object is to get the greatest possible effect from the fuel, and obviate the nuisance of smoke.

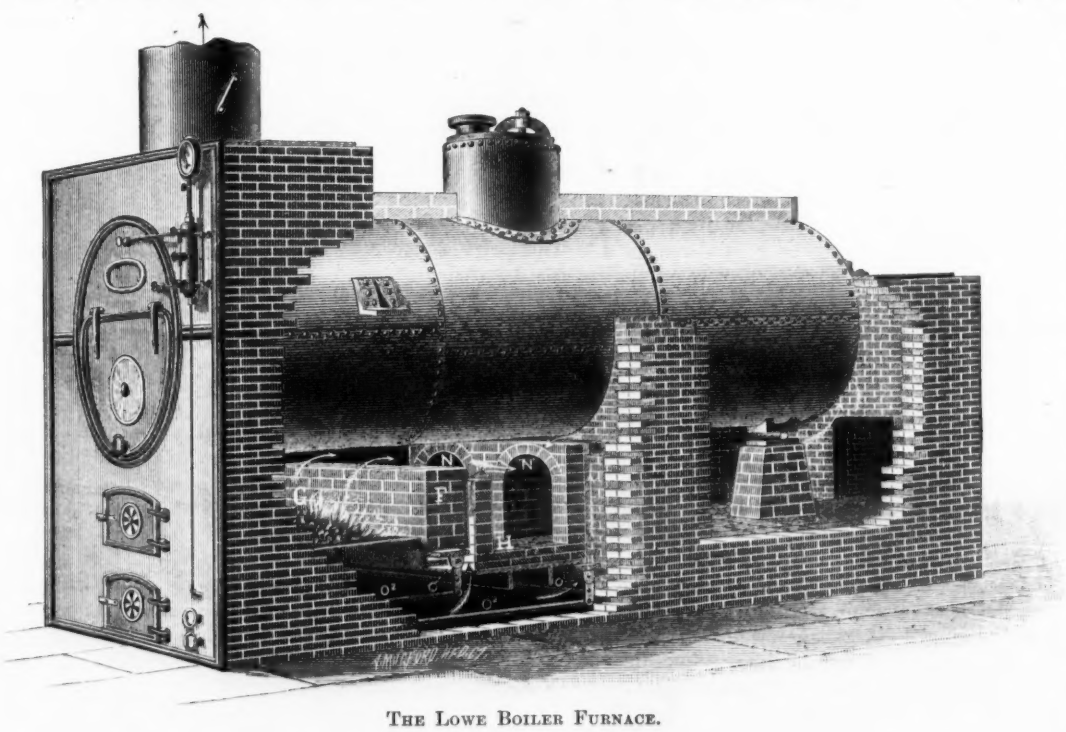
Referring to the engraving the heat and gases from the furnace *G* pass over the bridge-wall *F* into combustion-chamber *H*, and through the openings *N* into the space beyond, underneath the boiler. While the gases are passing through the combustion chamber they are heated therein and supplied with hot air through the air-gates *O*, both under and over them, the full width of the furnace, and are both thoroughly mixed in passing through the chamber, being divided in volume to pass through the openings *N* and brought together again in the chamber under the boiler.

The necessary supply of hot air is regulated by the air-gates *O* operated by the rods O^2 and their handles.

It will be noticed that the gases cannot escape contact with the air necessary for combustion, because they are forced to pass with it through the combustion-chamber, owing to the fact that the rear wall of this chamber closes the usual passage for the gases along the bottom of the boiler, compelling both air and gases to pass through the combustion-chamber surrounded by red-hot bricks.

It will also be seen that, should the air-gates be closed entirely, and no air supply furnished excepting through the grate and furnace door, that there must be a thorough mixing of the air and gases while passing through the combustion-chamber; also that the air-ovens and passages cannot be fouled, filled up, nor damaged by the working and cleaning of the fire, because, by opening the air-gates wide open, the ashes will fall out of the ovens and passages into the ashpit, and that the combustion-chamber is easily accessible for cleaning; and as neither of the air-ovens or passages are in the furnace walls, they cannot be broken into, nor damaged by the fire-irons, while working the fires.

These are important points, because they tend towards economy whether the boiler is being worked easily, or is being crowded.



THE LOWE BOILER FURNACE.

It is claimed for this furnace that it is designed in every respect to stand hard service, without giving out in any of its parts, which are protected from the fire, except where composed of regular fire-brick, and that the principle of its action cannot be changed or destroyed by use.

Etiquette in a Machine Shop.

BY JARNO.

There are books on etiquette treating the subject under headings: "Etiquette of the Ball Room," "Etiquette of the Drawing Room," "Street Etiquette," and so on. It is somewhere stated that a stage coach should be considered a drawing room on wheels; in these days, perhaps, a parlor car would come under the same head, but where should a machine shop be placed? There should be some code of etiquette established for a machine shop or more generally for manufacturing establishments. I offer a few suggestions in the formation of such a code, based upon the principles of common politeness as well as upon the principle of policy.

When visitors are shown through a machine shop some attention should be paid to what the entertainer may have to say. Visitors should not assume to explain matters to him as his time is valuable, and he cannot afford to give much of it away listening to things that may be already well known to him. A certain amount of time must be given to visitors as a matter of business propriety or courtesy, and perhaps as a matter of advertising, but the gauging of this should be left to the entertainer. A short time ago I was delegated to entertain a "M. E." As we came to a somewhat complicated machine, that had just been put in operation, he at once commenced to explain the machine to me. I assented to his explanations and we moved on. He turned back twice with remarks prefaced by "Let me see you do this by," etc. Now when he finally left the machine he had not discovered the vital principles of the whole invention. I should have been pleased to point it out to him, but could not get the opportunity. It often happens that there is some one in the shop, where a machine was invented and made, who knows and can explain as much about it as another can who sees it for the first time.

Visitors should keep conveniently near the entertainer, and not straggle.

I have known a party to become so scattered that couriers had to be dispatched to collect them.

Riding pig-back and playing leap-frog are out of place. A tendency to these may amount to a disease, and is peculiarly liable to attack students from polytechnic schools, whether because their brains (the students) do not appropriate sufficient nervous energy from a medium reserve to prevent some of it passing off in physical contortions, or because they have a plethora of nerve power, I am unable to state or diagnosticate. I have seen a student mount a high truck and sit there staring with his feet dangling.

Our acts may be judged when we least expect, and even in a machine shop criticism may be minute and just.

In going out doors, while passing between different parts of an establishment, do not light cigarettes. Some hotels post notices against cigarette smoking.

Generally a man who was in an office trying to sell goods would not light a cigar unless it was made in order by the proprietor. A student visiting an establishment alone would hardly light his cigarette; why will he do it when others are with him. The deportment of a class of naval students was commended by all.

When the officer said "Attention!" each produced his note book and wrote at the officer's dictation. They did nothing unbecoming "an officer or a gentleman." When they left the works they left also a good impression, and had some memento of their visit at least, and had acquired some information that might be of value.

It would be well if a visitor could refrain from tobacco chewing until he is again on the street. A foreman who had tried to entertain one of these tobacco fiends, went round the works afterwards, and did his best at making an apology for bringing such in. The fiend's expectorations had special reference to machine legs and bases, steam pipes and oil wells in the different machines.

When applying for work it is well not to

lean upon the foreman's desk, or other object. A man failed to get a job because he edged up to a lathe and leaned on it.

The foreman wanted to tell the man why he was not hired, but he did not. I tell him here.

A foreman was leaning against a bench for a moment; a man approached and also leaned against the bench as he applied for a job. There were two of them "you see," but one of them went away unsuccessful.

Older workmen should not make it awkward for a new comer by watching all his movements. A little attention at the right time may be a great help.

Many of us have a kind remembrance of some polite act by a fellow workman when we were new in the shop.

It is not quite polite to put your foot on a chair or stool even in a machine shop.

Do not mark on a drawing with a soft pencil. I knew a draughtsman to suspend work for an hour and a half because his superior had disfigured his drawing, in ordering changes.

Perhaps if men did not forget, there would be no occasion for these suggestions.

He who comes from Illinois or England to visit machine shops in Philadelphia does so for a purpose. If he can afford to come so far for the sake of telling how they do things in Illinois or England it is well enough to do so if he can find willing listeners, but I think he forgets.

The man who marked with a soft pencil upon a pencil shaded drawing was in the aggregate a gentleman, but he forgot.

Don't let us forget again.

Compound Locomotives.

The following summary of two papers read before the Institution of Mechanical Engineers is from *Engineering*. The papers were contributed by Alexander Borodin and Charles Sandiford:

The Russian Southwestern Railways with which Mr. Borodin is connected, in 1880, altered one of their locomotives to the compound system in accordance with the designs which M. Malet had introduced on the Bayonne & Biarritz Railway. At the same time another locomotive was provided with steam-jacketted cylinders. With these two engines the author made a series of tests, the details of which will be found in our abstract of the paper. One set of tests were made by taking the locomotive off the lines, and using it for running a machine shop, the exhaust steam being condensed, and its quantity and temperature measured, whilst indicator diagrams were taken at stated intervals. When working at reduced power, about 90 indicated horse-power, the utility of the jackets was proved.

The same engines were tested on the road, the speed of the trains being noted as well as the number of revolutions, the boiler pressure, the pressure in the jackets, the consumption of moist steam, the consumption of fuel (wood) and the quantity of steam condensed in the jackets. Indicator diagrams were also taken. Tests were made with six different positions of reversing lever with the simple engines, and at fourteen different positions with the compound engine. The ordinary locomotive, steam-jacketted, evaporated 3.33 lbs. of water per pound of wood, and the compound engine, steam-jacketted, 3.82 lbs. of water per pound of wood, showing a superiority of 14.6 per cent. in favor of the compound engine. This result is attributed to variation in firing and difference in wood. In one set of experiments with the jacketted compound far more steam was consumed than when the jackets were shut off; a result attributed to absence of circulation or failure to remove water. The following conclusions were arrived at as a result of the trials already referred to:

1. With the same expansion of steam, the consumption of water and of fuel is less in a compound locomotive than in an ordinary engine.

2. The economy of water and fuel in a compound locomotive, under the same conditions of expansion, is greater according as the range of expansion is higher.

3. With 4.8 fold expansion, the greatest which could be obtained with the ordinary engine, the compound engine gave an economy of 22 per cent. in steam and 32 per cent. in fuel.

Taking as a standard of comparison the work done by an ordinary and a compound locomotive with equal consumption of water and fuel, the following conclusions were arrived at:

1. For the same consumption of water and fuel per hour, the work done by the compound engine is greater than that done by the ordinary engine.

2. For the same boiler pressure and the same speed, the increase of work done by the compound engine compared with ordinary engines diminishes in proportion as the total consumption of fuel and water increases.

3. For an equal consumption of 4,800 lbs. of water per hour (with 141 lbs. boiled pressure, and 85 revolutions per minute), the work done by the compound engine is 19 per cent. greater than that done by the ordinary engine.

4. Under the same conditions, and for an equal consumption of 1,570 lbs. of fuel per hour, the work done by the compound engine is 32 per cent. greater than that done by the ordinary engine.

Trials made to test the comparative consumption of water and fuel in compound and ordinary engines doing equal work led to the following conclusions:

1. For doing the same work the compound engine uses less fuel and less water than the ordinary engine.

2. At the same boiler pressure and the same speed, the economy diminishes with the increase of work done.

3. With a pressure of about 136.5 lb., a mean speed of 85 revolutions per minute, and a total development of 190 horse-power, the compound engine gives an economy compared with the ordinary engine of 19 per cent. in consumption of steam, and of 29 per cent. in the amount of fuel.

In trials made with an ordinary engine, steam jacketted, it was found that with an expansion of 4.8 fold in the first notch an economy of 12 per cent. was obtained by the use of jackets. With an expansion of 1.3 fold the economy from the jackets became negative. With the compound engines the jackets gave "negative results," an "unexpected" phenomenon, which the author attributed to the intermediate receiver being placed in the smoke-box, and to the loss of steam in opening and closing the regulator.

Other tests made at another time with ordinary and compound engines while running, gave the following approximate conclusions:

1. When the jackets are not in use, the compound engine gives in comparison with the ordinary engine an economy of 13 per cent. In consumption of steam, and of 24 per cent. in consumption of wood.

2. Admission of steam into the jackets does not sensibly affect the consumption of steam in the ordinary engine; whilst in the compound engine it produces an injurious effect, and increases the consumption of fuel and water per indicated horse-power.

In summing up the results of his inquiries, the author says that: The steam jackets on the ordinary engine, while working in the testing shed in the first and second notches, undoubtedly gave a mean economy of steam of 16 to 13 per cent. In the experimental trains the jackets did not generally give satisfactory results, except when the ordinary engine was working in the first notch; but this must be attributed partly to the losses of steam necessary for warming up the walls of the jackets each time the regulator was opened, and above all to the defective drainage of the jackets, which probably transformed them into condensers. A better means of draining the steam jackets must therefore be sought for.

The compound system undoubtedly gave an economy of steam and of fuel; the amount of this economy varies sensibly with the conditions under which the engine is working, and in ordinary work it may be taken at from 15 to 20 per cent.

Mr. Sandiford's paper referred to experiments made with two converted engines. One named the "Vampire," had an 18 in. high and a 24 in. low-pressure cylinder placed in it. The stroke was 22 in.

There was an arrangement for admitting steam directly to the low-pressure cylinder steam-chest. This engine worked satisfactorily, no trouble being found in starting in practice. The consumption was 13½ per cent. less fuel than with an ordinary coupled engine with 16 in. cylinders by 24 in. stroke. The other engine, the "Vulcan," had four cylinders, viz., a pair of 11¾ in. high-pressure outside cylinders, and a pair of 17 in. low-pressure inside cylinders, all of 24 in. stroke. The crank-pin of each high-pressure cylinder was fixed opposite to the crank of the corresponding low-pressure cylinder. The distribution was by Stephenson link motion, with rocking shafts for working the slide valves of the high-pressure cylinders. The two high-pressure cranks being at right angles, the engine starts in any position. This engine heads the list for economy in fuel. In running 14,830 miles, the consumption averaged 33.13 lbs. of Bengal coal per train mile, with an average gross load of 520 tons, at an average speed of 20 miles an hour. In speaking of coupling rods, the author said that much more had been said against them than they deserved, as he found the brasses would run for years with scarcely any appreciable wear. Brass bushes forced into solid ends would last from three to three and a half years, or from 70,000 to 90,000 miles, as a common record; and then the play would be inconsiderable, say one-tenth in. In the four-cylinder engine the exhaust from the high-pressure cylinder was first taken to the low by short direct pipes, and afterwards altered so that steam was taken in a longer pipe, running round the smoke-box. This was found to be an improvement in getting drier steam in the low-pressure cylinders, and also a larger receiver. The four cylinder engine gives a sharper blast, and steams better than the two-cylinder engine. Drivers like the two-cylinder engine best, as does the author, for moderate loads; but the compound engines are considered by the author to be no more complicated than ordinary engines, so far as driving is concerned. The four-cylinder plan allows greater power to be reached, if wanted, as there is better steaming capacity. The pressure used, 120 lbs., was not sufficient to develop the full benefit of the compound system. For working a grade of 1 in 26 the author employs engines six-coupled, with cylinders 18 in. by 26 in., wheels of 4 ft. 2 in. in diameter, and puts three engines on a train weighing 250 tons, exclusive of engines. One engine pulls in front, and two push behind for the sake of brake power. Were it not for these excessive conditions, the author would have no hesitation in accepting the responsibility of recommending the compounding of the locomotives under his charge. It would not be easy to design compound engines as powerful as are necessary for this work. Nothing less than 20,000 lbs. of tractive force, at seven miles per hour, would at all approach the requirements.

DISCUSSION.

Mr. Halpin noticed that Mr. Borodin attacked the problem from a different point of view from that selected by M. Malet. The latter took coal, water and load as the elements of comparison, but the former had not referred to load, but based his conclusions on coal, water and indicator diagrams. With regard to this the speaker thought that there would be probably important errors from the fact that the indicators were, as shown by the drawings on the walls, placed at some distance from the cylinders, the pipes connecting the two being long, and by no means straight. As an instance of the evils that might arise from this cause, the speaker stated that in one case that came under his observation a gain of 28 per cent. of power was apparent according to the diagrams of an engine, when the indicator was placed nearer the cylinder and the pipes put right. Mr. Halpin showed an indicator diagram on the wall exhibiting the defect referred to. The author had referred to the want of drainage of the jackets, and had compared them to condensers. But if they were condensers Mr. Halpin said they should have an air pump. The trap the author had used, which was illustrated by a drawing on the wall, and in which the opening and closing of a valve was effected by the expansion and contraction of metal under varying temperatures, had been, the speaker said, used in England, and Mr. Webb had traced a loss of 53 per cent. in the cylinders to this device. The speaker illustrated an arrangement he had devised in which an auxiliary injector was used for taking the condensed water from the jacket and putting it back into the boiler through the feed injector. In considering the action of steam jackets, three points must be observed: First—The greater the expansion in the cylinders, the greater the value of jacketting. Seeondly—The higher the piston speed, the less the necessity for jacketting. Third—The ratio of the jacket to the cylinder. A popular error often met with was that the maximum surface available was the barrel of the cylinder plus the two ends—a fallacy that the speaker had heard Sir Frederick Bramwell put forward in the room the meeting was then occupying. But by a proper disposition of material the effective surface could be increased, just as a plain hole in the bottom of a tank could be made to discharge more water if *vena contracta*. Mr. Halpin had prepared a drawing showing the manner in which he would reach the desired end of giving greater surface for the conduction of heat from the jacket steam to that in the cylinder. For this end a number of annular ribs were cast on the cylinder, and the additional surface so attained would produce the desired result. The author had shown a form of brake commonly in use. This, Mr. Halpin considered, had drawbacks because of the heat engendered by friction. He had devised a plan by which this difficulty might be overcome. The wheel was made with a hollow rim which would contain water that would be constantly fed into it. For removing the surplus water a pipe was led from the enclosed space in the rim to the outer atmosphere. As the wheel revolved, the water would be thrown against the inner surface of that part of the wheel in contact with the brake-blocks by the centrifugal action, and when the water became overheated the surplus would be taken off in the manner that the lighter constituents of milk are extracted in an ordinary centrifugal cream skimmer. The author had referred to a loss of pressure in his experiments. This, the speaker thought, was due to the friction in the steam pipes, which were too small. There were only two objections to large steam pipes. One was the loss that might occur through radiation, and the second was additional expense. But in this case the pipes were in the smokebox and the expense was trifling. The steam velocity, the speaker said, was too high, in some cases as much as 420 feet a second.

Mr. Davey had heard the question of steam jacketting cylinders discussed for the last fifteen years, but we were very little advanced in our knowledge of the subject. What was wanted was that a definite series of experiments should be conducted, and the information brought together and arranged so that a definite value might be given to the subject. The speaker then made a sketch on the black-board showing what he considered a proper jacket. In the ordinary arrangement a narrow annular space is left for the steam to circulate in, but in Mr. Davey's sketch the cylinder was represented as contained bodily within a large case of many times larger capacity than the cylinder itself, so as to give a large body of steam from which heat might be drawn.

Professor Kennedy asked whether in Mr. Borodin's experiments the jackets were always worked by the trap and never by hand, and also whether the cylinders were covered in any way. He thought that the pipes between the indicators and cylinders being so long would vitiate the results calculated from the diagrams. In illustration of this point, he mentioned a case in which he made communication between the cylinder and indicator by means of a 6 in. length of straight pipe. This was in testing a compound en-

gine, and the disturbance due to this connection was found to make so great a difference as to render the data useless. He was glad to have that opportunity to express a doubt as to the value of information obtained from indicator cards for purposes of calculating definite powers. Mr. Borodin had measured the water discharged from the jackets; but the speaker thought he had not allowed sufficiently for loss of heat not imparted to the steam in the cylinders. He, the speaker, thought that if the trap discharge had been measured when the engines were at rest, it would have been found to be a somewhat close approximation to that obtained with the engines at work. This point had not been considered by the author of the paper. It could not be too often insisted that if the jacket were not properly drained it was worse than useless; and unless makers of engines provided jacketted engines with an automatic draining arrangement, they had better put a blank flange on the steam supply when they finished the job. The speaker approved of Mr. Halpin's highly ingenious modification in the brake, but suggested some alterations, which he illustrated by aid of a sketch on the black-board. In conclusion, he thought the thanks of all were due to Mr. Borodin for his frank record of failures, as well as successes. Such a course added confidence to one's estimate of the results; and not only that, but often more light was obtained from failures than when all went smoothly.

Mr. Rich said that he had raised the question of steam-jacketting when Mr. Webb had read his paper on the compound locomotive some time ago, and had pointed out the necessity of considering this question in the case of locomotives. It was, the speaker said, impossible to get a high economy without steam jackets, at any rate with low piston speeds. At the well-known Cardiff trials, all those engines not fitted with jackets were entirely out of the competition. He thought that a fan should be used in locomotives for urging the fires and all the pressure kept for the cylinders. For equalizing the work in the cylinders at different loads and gradients there must be double slide valves on each cylinder, and they must work independently of each other.

M. Vincotte condemned the device used for draining the jackets in Mr. Borodin's experiments. It acted on expansion, and the water must therefore be cooled before it can escape. He did not think any value could be attached to results obtained with this trap. The speaker had made many experiments with steam jackets, and always found the great trouble to be the draining off of the condensed water, and no good could be effected unless the jackets were drained. With regard to what Dr. Ryan had said about conductivity of heat, direct experiments had been made in connection with sugar-making on this subject. For instance, steam flowing through a pipe gives better results, as to transmission, than when not in motion. This was due to a film of water that collected on the surfaces. The speaker did not wish it to be understood he altogether approved of the ribs, but the question was how to remove the film of water. Mr. Halpin's arrangement of injector for removing water from the jacket was open to this objection, that it would lower the pressure in the jacket, and this would lower the temperature, which would be as bad as filling the space with water. As to the long indicator pipes referred to, he thought that there could not be much loss of pressure, judging from the appearance of the diagrams on the wall. The speaker drew a diagram on the black-board, which he thought would have been produced if there had been much loss of pressure. This had the well known loop to the admission line, which did not exist in Mr. Borodin's diagrams.

Mr. D. Greig said that on so short a notice it was impossible to criticise properly a paper containing so many tables of figures, and dealing with such a variety of experiments as that of Mr. Borodin's. Speaking generally, it had often been a matter of astonishment to him, as a maker of portable engines, that locomotive engineers did not get more nearly the good results as were obtained with portable engines. No doubt, in the latter, the cylinders were on the top of the boiler, and in this respect there was a great gain, as jackets could be drained by the sure process of gravitation. As a result of experiment, the speaker had found that a loss of 7 per cent. had been found to attend the absence of jacketting. He was of opinion that there would be no gain from compounding with pressure so low as 60 lbs. to 70 lbs, and therefore the experiments quoted by the author at those pressures possess little value. To attain the full value of compounding, they wanted pressures not less than 120 lbs.

Mr. T. Hurry Riches pointed out that in Mr. Borodin's paper he did not see any data given showing a consumption per ton load per mile. That was the best data on which to base an opinion of the efficiency and economy of a locomotive engine. In Mr. Sandiford's paper there was a lack of the same information. The economy quoted by the latter author for the compound engine was no better than English engineers were accustomed to with ordinary engines, and they would want a greater inducement to cause them to adopt the system. As to draining jackets, he had put a float valve for that purpose, and this worked not by the temperature of the water, but by its height. He had tried a fan for forcing the draft in locomotives, the experiment being continued for three or four months with closed ashpit. It had not, however, paid for the complication, and was discontinued.

Mr. Crampton had studied the question of locomotive practice for over forty years. He had made experiments not only with jacketted cylinders, but with jackets in which there was superheated steam, but had not gained much in that way. He had designed locomotives with jackets, in the year 1857, and exhibited the original drawings from which some engines had been built. He regretted he had no results to give the meeting, as the superintendent engineer of the line had had a contempt for all such devices, and would take no trouble to have them tried. Mr. Crampton thought that a committee should be formed to inquire into the question of steam-jacketting, and the opinions of engineers of all countries should be solicited.

From Southampton to Halifax in 24 hours and from New York to Calcutta in 10 days, is the latest scheme of a Pennsylvanian, who is experimenting to that end.

Montpelier, Vermont, has an electric light installment which is operated by motors which take their power from the water works pipes of the town.

Moulding Screw Propellers in Loam.

BY CHAS. A. DEVLIN.

The foundation plate *A*, as shown in Fig. 1, should be leveled up true in the pit, and should be about 2½" thick, and made the shape of the screw with allowances for joints and lugs at proper intervals. It may be perforated with holes, made with cores or pieces of brick to allow the free escape of gases, and for better drying.

The bearing *B* and *C* are then swept up on one course of brick by a sweep that will also form the base of the hub high enough to allow the blades to be built. On this sweep notches are cut to indicate on bearing *B* the proper place for the guide board *D*, and the joint board *E*. The bearing is thus divided into four right angles, with center at the hub, which will show the true center on bearing *B* to which the center marked on the guide-board at *a* is placed. The false hub is then swept up by a sweep made for it.

The guide board should be beveled on the top edge, and a strip of hoop iron screwed on to insure easy and accurate, travel for the sweep, which works with a counter balance weight *Z*, and when drawn down the guide board describes the face of the blade. Notches are filled in the guide board at *a*, *b*, *c*, and by scribing along the sweep from the notches to the hub, gives the top, bottom and center of the blade. The joint board *E* serves as a protection to the guide board, and also makes a neat joint, as does the joint board *F* on bearing *B*.

When the guide board *D* and the joint boards *E* and *F* are properly secured the bricking commences. Good, soft brick should be used, and kept the proper distance from the face of the mould to prevent scabbing. The pier should be built open with plenty of cinders champed in between the joints of the brick work to allow vent; in the back of the pier brick should be left out occasionally for vents, also. The brick work finished, the pier should be loamed up and finished off.

The notches filed in the sweep 1, 2, 3, 4, 5 will describe on the pier the proper place for the thickness strips, which are cut out by the pattern maker, and are cross sections of the blade at different intervals. They are generally about ½" thick and pliable, so as to bend readily to the proper curve, marked on the pier. They are fastened on with nails or brads at their proper places.

A good idea is to make the form for the outer edge of the blade of a strip of lead properly shaped as *e*, *f*, *g*; it makes a much neater job, and the outside will be uniform in thickness, especially in composition wheels which are generally much thinner than iron ones.

When the thickness strips are fastened on, strong green sand is to be used to fill in with. It should be packed hard and struck off with small strips properly curved for the top of the blade. The strips may then be drawn, and their places filled in with sand, when you have the proper shape of the blade. Clean the pier and spread oil over the face and joints, and shake on parting sand, then you are ready for the cope.

This style of a cope is interesting; shown in Fig. 2. The lifting and binding plates—1, 2, 3, 4—are cast in open sand, as are the binding irons, Fig. 5. The lifting plates 1 is about two inches thick, with lugs at proper intervals. Three bolts are cast in this plate for securing the binding irons. The binding irons are made long enough to secure the top binding plates. After the cope is bricked up, a top plate 5, Fig. 3, about two inches thick, with prickers about one inch long, is then bedded on, after being loamed up. Binding bolts are then put through the lugs and screwed taut, when you have the cope safe and sound.

In the top plates staples are cast, as *h*, *i*, *j*, Fig. 4, to lift the copes by, after you have made proper marks and guides. After all the copes are built, the next thing is to make over the top of the hub. The best way is to sweep up a seat for the hub-plate *m*, which is cast with a hole for the core print and gates, *n*, *o*, *p*, and feeding head *g*. This plate is cast with prickers the proper length to extend down to the top of the hub; it also has four bolt holes cast in the lugs to correspond with small bolts cast in the top plates to secure it by, as *r*, *s*, *t*, *u*.

After the mould is all bricked up, it is taken apart, the thickness sand taken off and the false hub dug out, when it is ready to be dressed. If the screw is too large to be put in the oven, the piers may be dried by building fires between them, and placing a curbing around and plates over the top of it. The copes can be put on a carriage and dried in the oven. When dry, set the core and put the mould together, and bolt up by the binding bolts 1, 2, 3, Fig. 4, from the lugs on the foundation plate, through the lugs on the cope plates. Risers may be taken off from the highest point of the blade if the blades be thin. For greater safety in securing the mould, the cross and slings may be used, but it is hardly necessary.

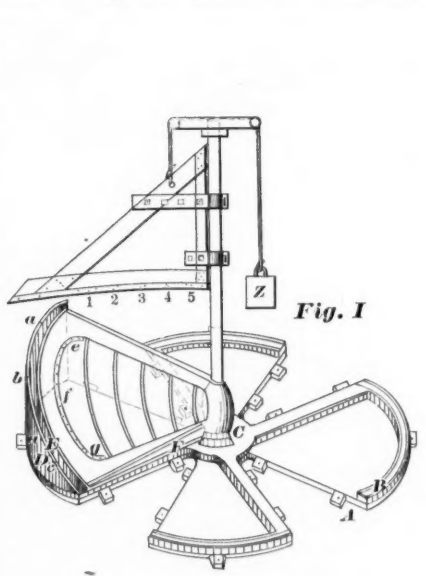


Fig. I

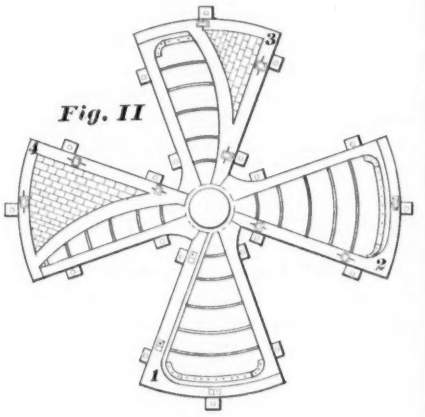


Fig. II

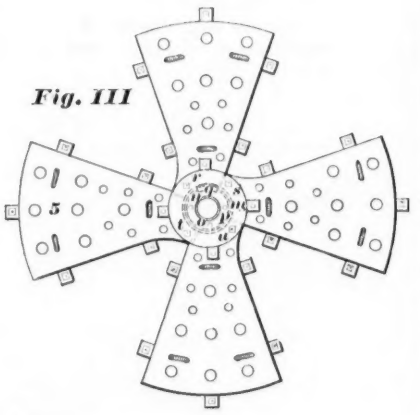


Fig. III

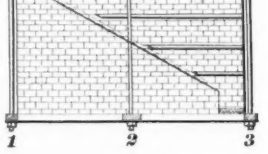


Fig. IV

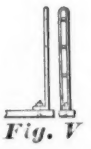


Fig. V

MOULDING SCREW PROPELLERS.

The Humane Society of Pittsburgh proposes to secure the passage of a law requiring horse-car conductors to display a sign whenever the prescribed limit as to number of passengers is reached. What is the prescribed limit? No one ever saw it reached in this part of the country.

Recent improvements in diving apparatus is the use of telephones for communication between the diver and those working the pumps and machinery.

A writer in the *Milling Engineer* puts solid truth in the following:

"A good many men in this world run away with the idea that they are working for Mr. Smith, Mr. Jones, or Mr. Robinson, and they take very good care that their employers get no more than they pay for. If they receive low wages for their service, they render a return in kind, and jog along in their little rut as contented as possible. Now this is a great mistake for any workingman to make, for he fools no one but himself by such a practice. It is a mistake for any workingman to suppose that his employers do not rate him at his exact value, and know whether they are paying too much or too little in any given case. Labor is one of the greatest items in all operations, and employers are keenly alive to the fact. Men who measure out scant work for the pay they receive, or who measure their work by their pay at all, are injuring no one more than themselves, for in a slack time, or in competition with others, they are the first to be laid off, or the first to be swapped off for the men who promise better."

Power Absorbed in Cutting Cast-Iron.

BY JAMES F. HOBART.

SECOND PAPER.

The belts driving both dynamometer and lathe being new, it was necessary to shorten them up by cutting one inch from each belt. Upon starting the lathe after this operation, the friction ran at 10 5 lbs. for nearly one hour, after which it gradually decreased for two hours more, when it again reached 8.25 lbs. The speed of the lathe with belt on different steps of pulley was determined by counting dynamometer revolutions, when turned by hand, until the lathe spindle had made one complete revolution, as indicated by a surface gauge and a mark on face-plate.

With lathe back-geared, belt on largest step of spindle pulley, the speed was 43¾ to 1 of dynamometer. With belt on the next step, speed was 25 to 1, then 15 to 1, and 9½ turns of dynamometer to 1 of lathe spindle.

With back gear out, the speeds of spindle were 4½, 2¾, 1⅔, and 1, to one of dynamometer.

The power consumed in running the lathe and work at these proportionate speeds, while dynamometer revolved 365 per minute was, beginning with highest speed and working to slowest, respectively 16.5, 10.50, 7.75 and 6.75 lbs.

At this point the back gear being thrown in the remaining speeds consumed 13.00, 9.50, 6.75, and 7.25 pounds of belt pull.

A discrepancy is noticed between the amount of power required by the two last speeds, and any two preceding ones. According to the ratio of decrease, the power should have been about 6 pounds, or a little less, when it is seen to be 7.25 pounds. An inspection of the lathe revealed that the back gear hollow shaft touched the belt when it was upon the largest step spindle pulley, and when the back gear was thrown forward into gear by its cam motion.

Under similar conditions, but with tool set at an angle of 60 degrees with axis of work, the power required was 318.58+ pounds at a speed of 31.59 feet per minute.

Fig. 7 shows the tool set at an angle of 90 degrees, or "square" with the work. This position required 422 pounds 30.14 feet per minute.

With the tool turned to form an angle of 30 degrees, the power required was 438.4 pounds, or 26 pounds net pull upon the driving belt running 629 feet per minute.

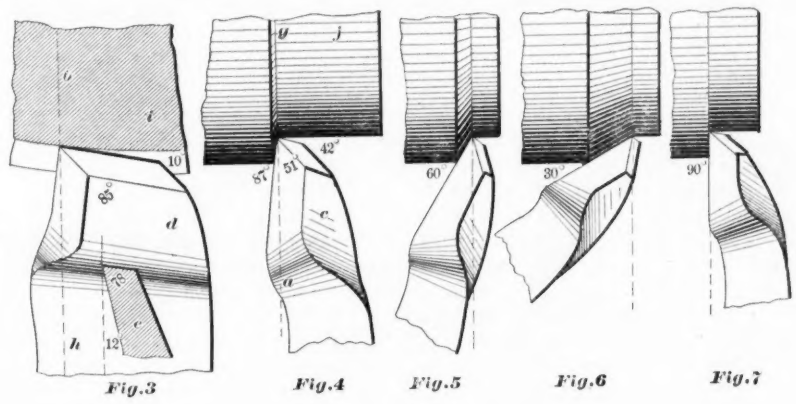


Fig.3 *Fig.4* *Fig.5* *Fig.6* *Fig.7*

In these examples, the rake or pitch and clearance of tool were each 12 degrees, and the shear, as seen at *e*, Fig. 3, is 73 degrees.

With a feed of $\frac{1}{68}$ inch, the power required is 375.77 pounds, and with a feed of $\frac{1}{115}$ inch. 313.14 pounds.

At the close of the above tests the tool was ground down to look like Fig. 8, giving the angle of depression at 17 degrees. In this condition the pull was 305.13 pounds.

Elevating the tool to position shown by Fig. 9, 7 degrees above center of work, the power rose to 322.76 pounds against 422.92 pounds when set level as in preceding side tool trials.

Grinding the tool to shape seen in Fig. 10, and setting it at an elevation of 25 degrees did not change the amount of power required, although the tool now is in a position which should cut easier according to shop traditions.

By dropping the tool point 5 degrees below zero, as in Fig. 11, the power consumed amounted to 350.84 pounds, and the point of the tool soon went after more power yet.

The following table will give the result of the side tool trials, but it must be borne in mind that this tool is not a theoretically correct one; but was picked up at random, the "perfect tool" will be treated later.

The feed, in all cases, unless otherwise stated, is a rod friction feed driven by a belt, and is found by actual count to be 44.5, 68, and 115 cuts per inch. For tests of coarse feeds the positive screw feed will be used.

The power required to drive the lathe, while no work is being done by the tool, is tabulated below, and embraces two speeds of dynamometer.

This table will prove an interesting study. As an instance, the power necessary to increase the speed from 365 to 375 revolutions of the lathe spindle is 5698.25 foot pounds, or more than half as much than is necessary to do all the work at 365 revolutions.

Again, with the spindle back geared, at its slowest speed, an increase of 860.75 foot pounds is necessary, or but about ⅛ more power to make the desired increase of 10 revolutions at the dynamometer, or but about ¼ of one revolution increase of speed per minute at the lathe spindle.

POWER REQUIRED TO RUN EMPTY LATHE.

Lathe Belt on the	Speed of Dynamometer, 365.			Speed of Dynamometer, 375.		
	Speed of Spindle.	Dyna. Pull.	Foot Pounds.	Speed of Spindle.	Dyna. Pull	Foot Pounds
Large step.	81.111+	6.75 lbs.	4188.375	82	7.5 lbs.	4781.25
2d "	132.727+	7.75 "	4808.875	136.363+	10 "	6875
3d "	219 087+	10.50 "	6515.25	225.090+	14 "	8925
Small "	365	16.50 "	10238.75	375	25 "	15937.5
BACK GEARED.						
Large step.	8.3428+	7.25 lbs.	4398 625	8.571+	8.25 lbs.	5259.375
2d "	14.6	6.75 "	4188.375	15	7 50 "	4781.25
3d "	24.333+	7.50 "	4658 75	25	10 "	6375
Small "	38 421+	13 "	9066.5	39.473+	15 "	9562.5

ORDINARY SIDE TOOL.

Speed.	Angle.	Shear.	Elevation.	Feed.	Power.	Condition of Cut.
32.60	84	30	0	44.5	233.89	Clean, nice.
31.59	60	30	....	44 5	318.58	Good.
31.85	60	30	....	68	256.67	Good.
31.85	60	30	....	115	177 69	Fine
53.57	60	30	....	115	140.88	Very good.
53.57	60	30	....	68	223 09	Fair.
30.14	90	30	....	44.5	422.92	Rough and hard.
30.14	90	30	....	68	338.38	Crumbly chips.
30.13	90	30	....	115	229.61	Not very good.
52 77	90	30	....	44 5	381.36	Smoking.
52 77	90	30	....	68	262.23	Fair.
52.77	90	30	....	115	178 79	Good.
30 13	30	30	....	44.5	438.4	Slight chatter.
30.13	30	30	....	68	375.77	Bad chatter.
30.13	60	30	....	115	313.14	Chatter.
52.77	30	30	....	44.5	417.17	Good, belt slips.
52.77	30	30	....	68	262.23	Chatter.
52.77	30	30	....	115	166.87	Bad chatter.
25.64	90	18	—17	68	305 13	Good.
25 27	90	18	7	68	322.67	Nice rolling.
25.27	90	18	25	68	322.67	Fine rolling.
25.27	90	18	— 5	68	350.84	Fair.

For experiments with the diamond point, a tool was chosen which was about half worn out, the cutting surface had been ground down below a line parallel with top of the tool as shown by Fig. 13.

The tool while in this shape does not show a tendency to dig into the work when taking a heavy cut. Figs. 12 and 13 show about the shape of the tool, the manner in which it was set, and at *d*, the shear of the tool.

In this condition a force of 312 pounds was necessary to cut off a chip $\frac{1}{8}'' \times \frac{1}{8}''$ in a wretched chattering manner, and from the excessive clearance, 30 degrees, soon taking off the point of the tool.

By elevating the tool 10 degrees, as shown by Fig. 15 the cutting force was reduced to 258.40 pounds, the chatter became very slight and the cut looked cleaner. In this case the clearance was 20 degrees, still too much.

Fig. 16 shows the top of the tool elevated 16 degrees above the radial line of the work *a b*. In this position of the tool 200.29 pounds pull is required, giving a fairly smooth cut, and reducing the clearance to 14 degrees.

Next, the tool was revolved in the tool post until it was in the position shown by Fig. 17. Here, with top of tool in line radially, as in Fig. 13, the shear of tool on work being 30 degrees, the power required was 312.15 pounds with a determination, on part of the tool, to chatter slightly.

By revolving the tool to the position shown by Fig. 18, and elevating it 5 degrees to correspond with Fig. 14 the clearance was reduced, the shear of tool relative to work reduced to 23 degrees, and but 216 pounds pull, required to give a nice, smooth cut free from chatter.

If the tool be again placed in its original position, Fig. 12, but elevated 18 degrees, the pull will be 222.42 pounds and a neat smooth cut will be the result. In this instance the shear of tool on work is 27 degrees.

Under the same conditions as above, but with a feed of 44½ cuts per inch, instead of 68, the pull on tool is 240.53 pounds. With a cut of 115 per inch, the pull is reduced to 196.5 poonds.

The lathe belt was then placed upon the second step of spindle pulley, giving a lathe speed of 14.6 revolutions per minute, and 50.46 feet per minute for velocity of the work. With a feed of 68, 217.77 pounds pull is required.

The tool, after being ground to a shear of 45 degrees, like *a*, Fig. 19 was reset as in Fig. 12, except it was raised until top of tool stood in a line 25 degrees above center of the work. Still the tool gave a chattering cut with 202.66 pounds pressure. The shear of tool in relation to work was but 27 degrees, although the tool was ground to a shear of 45 degrees, the difference being caused by relative positions of tool and work. In this case, the belt was replaced on large step of pulley, and speed of work was 28.64+ feet per minute.

By elevating end of tool to 38 degrees, the body of tool then making an angle of 12 degrees with the horizontal, the shear of tool against work became 30 degrees, giving a first-rate smooth cut of 28.64+ feet per minute with a pull of 206.46 pounds—a little more than in the last case, but the surface velocity of work is slightly greater.

Upon lowering the tool to 1 degree above level, the line of cut, or tangential angle of tool, was 15 degrees above center of work, and power consumed, 236.8 pounds.

Upon grinding the tool stunt, making the shear 20 degrees, and placing it in shape of Figs. 12 and 13, the shear of tool on work became but 10 degrees, causing a bad chattering cut with a pull of 278.45 pounds.

Elevating the tool 5 degrees caused the pull to be reduced to 201.89+ pounds, but the cut was still in a horrid condition.

Grinding the tool down to 15 degrees, like *b*, Fig. 19, had the effect of making a wretched cut with 248.07 pounds when set as in Figs 12 and 13.

The intention was to grind the tool still more stunt like *c*, Fig. 19, but results of the last shape, *b*, effectually discouraged any further experiment in that direction, the chattering of work, although together with the arbor it weighed over 300 pounds had shaken down upon the floor everything movable within 10 feet of the lathe.

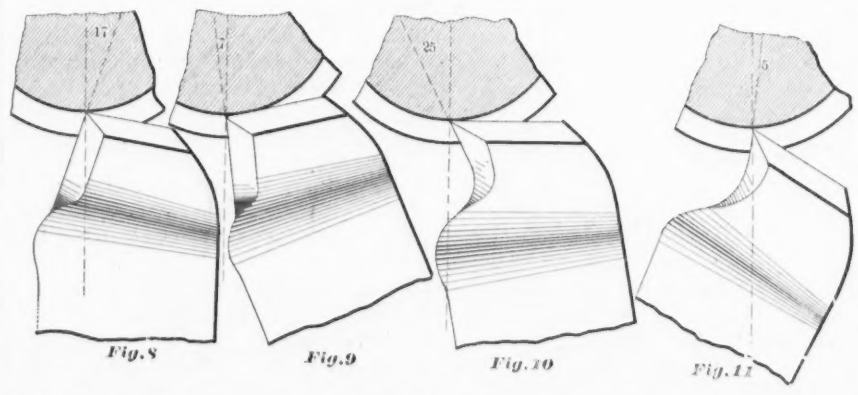


Fig.8 *Fig.9* *Fig.10* *Fig.11*

ORDINARY DIAMOND-POINT TOOL.

Speed.	Angle.	Shear.	Elevation.	Feed.	Power.	Condition of Cut.
30 8	45°	16°	..	68	312.12+	Chatter
29.21	45	13	10	68	258 40+	Slight chatter.
29.99	45	13	16	68	200 29+	Fair
29.99	90	30	..	68	312.15	Slight chatter.
29.31	60	23	5	68	216	Smooth.
28.82	45	27	18	68	222.42	Good.
28.82	45	27	18	44.5	240.53	Better than last
28.82	45	27	18	11 5	196 5	Equal to last.
0.16	45	27	18	68	217.77	Very good
28.36	45	27	25	68	202 66	Chatter.
28.64	45	30	34	68	206 46	Very good.
28.64	45	25	15	68	236.8	Chatter.
28 64	45	10	..	68	278 45	Bad chatter.
28.64	45	10	5	68	201 89	Bad chatter.
28 64	45	8.5	..	68	248.07	Tremendous chatter

The "round nose" or "brass" tool, shown by Figs. 20 and 21, probably has no equal for heavy rough work where plenty of power can be applied, as this tool stands up well to the

work; there is a large amount of metal in position to quickly convey heat generated by the cutting edge, which helps largely to make the tool stand up well when roughly used.

With a tool ground and set, as in Figs. 20 and 21, the shear, 5 degrees as at *a*, Fig. 21. clearance 12 degrees, the pull necessary to take off $\frac{1}{8}''$ of iron 68 cuts per inch at 30 feet per minute is 344.85 pounds.

When the tool is elevated 10 degrees, as in Fig. 23, the pull was 366.07 pounds. An elevation of 13 degrees required 387.29 pounds, but when the tool in Fig. 20 was revolved to the left until it stood at an angle of 60 degrees, with an elevation of 10 degrees it required but 360.77 pounds pull.

Grinding the tool to a shear of 17 degrees, and setting as above, reduced the pull to 297.10 pounds, but lowering point of the tool 10 degrees until it is on a radius, as in Fig. 21, sent the pressure up to 327.68+ pounds.

Setting the tool again, as in Fig. 20, the pull was 262.83 pounds, a decrease of 82.02 pounds pull for an increase of 12 degrees in shear. Elevating the tool 28 degrees caused the pressure to jump up to 309.53 pounds, requiring more power, instead of less, than would be supposed.

A reason for this paradoxical occurrence is found if we stop to think how that curved cutting edge must act as it is forced up under the chips, its highest point being in the center with uncut metal binding both ends of the chips.

The tool was reground to a clearance of 13 degrees and a shear of 10. Set at an angle of 68 degrees, and elevated like Fig. 21, the shear relative to the work became 13 degrees, and the tool used up 247.23+ pounds at the rate of 28.36 feet per minute, and chattered slightly.

Changing the feed to 115 cuts per inch increased the chatter, and reduced the pull to 179.82+ pounds, while shifting the feed to 44.5 cuts per inch required 356.13 pounds pull on the tool, but gave a good smooth cut and consumed 10200 foot pounds of power.

The lathe belt was then shifted to step No. 2, giving a speed of 49.5 feet per minute. A good cut was obtained with 17850 foot pounds, equal to 360.6+ pounds pull on the tool and at 44.5 cuts per inch.

At 68 cuts per inch the tool chattered under a pull of 199.64 pounds, while 115 cuts gave a very bad chatter with but 170.62 pounds pull, and used up 8446.87 + foot pounds.

The speed of work is carried to excess in this and the preceding examples for the purpose of securing data for comparison.

With tool in same position as last trial, but with belt on third step pulley, giving a speed of 128.52 feet per minute, the pull was 146.84 pounds on tool, cutting 115 chips per inch, and consuming 18870 foot pounds.

At 68 cuts per inch foot pounds were 22631.25, and pull on tool 176.86 + pounds against 200.66 pounds with 44.5 cuts per inch, and an expenditure of 25789 foot pounds, exclusive, in all cases, of power necessary to run lathe when not cutting, friction of countershaft and clutch pulleys.

An adjustable diamond-point tool, made by

ORDINARY ROUND-NOSE TOOL.

Speed.	Angle.	Shear.	Elevation.	Feed.	Power.	Condition of Cut.
30.04	90°	5°	0	68	344.85+	Chatter.
30.04	90	5	13	68	387.29+	Fair cut.
30.04	90	5	10	68	366.07	Cuts free.
30.04	60	5	10	68	360.77	Good.
30.04	60	17	10	68	297.10	Very good.
30.04	60	17	0	68	277.68	Chatter.
30.15	90	17	0	68	262.83	Fair cut.
30.66	90	17	28	68	309.53	Good.
28.36	68	13	0	68	247.23	Slight chatter.
28.36	68	13	0	115	179.82	Chatter.
28.94	68	13	0	44.5	356.13	Good.
49.5	68	13	0	44.5	360.6+	Good.
49.5	68	13	0	68	199.64	Chatter.
49.5	68	13	0	115	170.62	Chatter bad.
128.52	68	13	0	115	146.84	Fair.
128.52	68	13	0	68	176.86	Rough and poor.
128.52	68	13	0	44.5	200.66	Horrid.

the Hartford Tool Company, consists of a bar of steel $\frac{1}{2}''$x$\frac{9}{16}''$ cross section; and fitted into a grooved body which gives support to the small piece of steel bar which does the cutting. A grooved cap is placed on the tool and the action of the tool-post screw, clamps the three parts together.

This tool was ground and set as in Fig. 24, to an angle of 65 degrees, and "square" with the work, both horizontally and axially.

Rake was given this tool by tipping the cutting bar, as seen in section *C*. With a clearance of 11, and a rake of 5 degrees, 287.95 pounds pull was sustained at point of the tool in cutting a chip $\frac{1}{8}''$x$\frac{1}{8}''$ with a shear of 16 degrees. The cut was smooth and

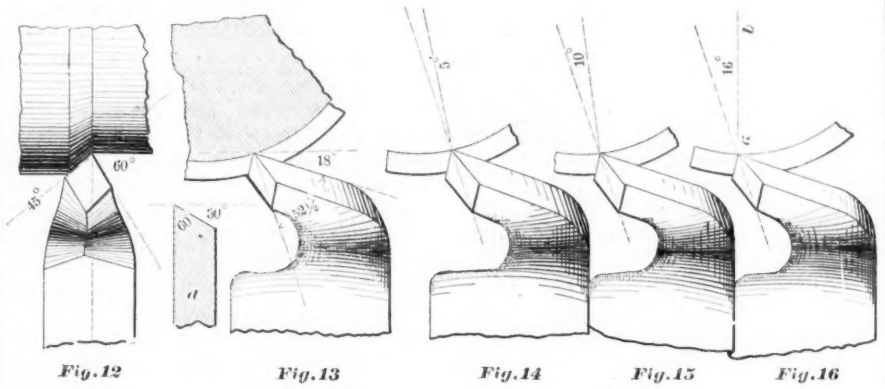


Fig.12 Fig.13 Fig.14 Fig.15 Fig.16

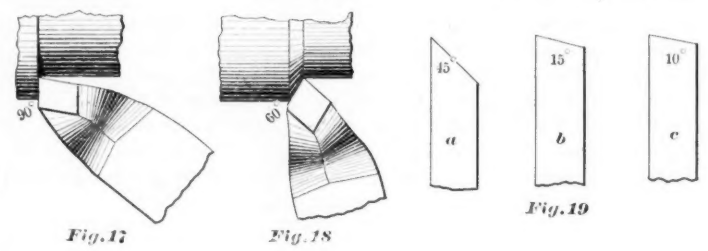


Fig.17 Fig.18 Fig.19

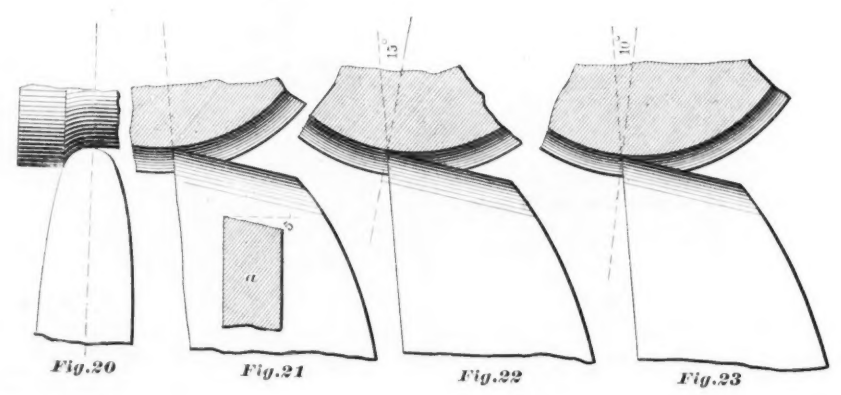


Fig.20 Fig.21 Fig.22 Fig.23

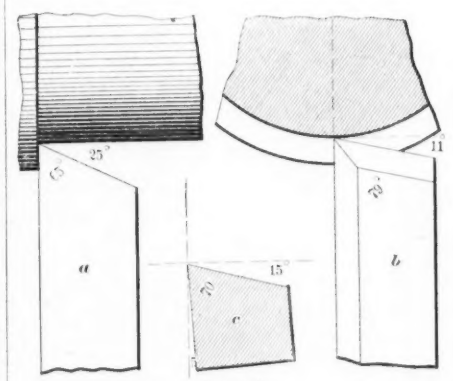


Fig.24

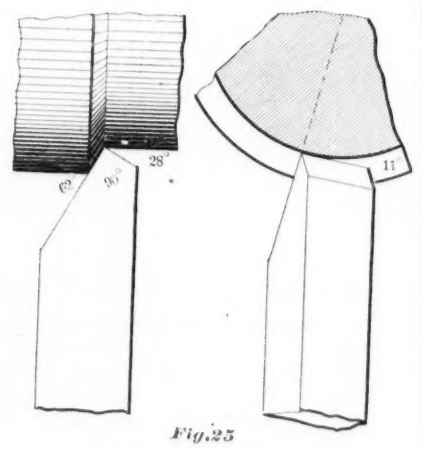


Fig.25

looked like a good position to have the tool "stand" well.

Revolving this tool in a manner similar to that shown by Fig. 18, so as to bring the cut at an axial angle of 80 degrees, the power increased to 322.75 pounds. Upon examination of the tool point, it was found to be broken so as to leave a triangular section $\frac{1}{16}''$ across, exposed to the work, in place of a good cutting edge.

The tool was reground and set as before, except at an axial angle of 75 degrees. Here the power required was 243.12 pounds, and a further revolution of the tool to 70 degrees, resulted in reducing the power to 237.01 pounds.

At 65, and 60 degrees the same power was required as before, but at 55 degrees, the power only figured up 230.43 pounds, probably caused by soft iron, as the cut made by this test was at the softest part of the casting.

At 50 degrees the power again stood at the old figures of 237.01 pounds, and continued there at 45, 40 and 35 degrees, when the tool was reset at an axial angle of 70 degrees, and the point of tool elevated 11 degrees, but the dynamometer gave the same reading of 237.01 pounds pressure on the tool.

It would look reasonable to suppose that the tool would cut easier when the point was raised, as is the case with some other forms of tools, but by raising thus, the shear was increased but very slightly, owing to the large axial angle of tool, while, at the same time, the point of the tool was forced to cut in advance of the removal of the chips from the work, thereby neutralizing the slight gain by the increased shear.

With the same tool body above used, is furnished a tool ground as shown in Fig. 25, and which acts like a side tool.

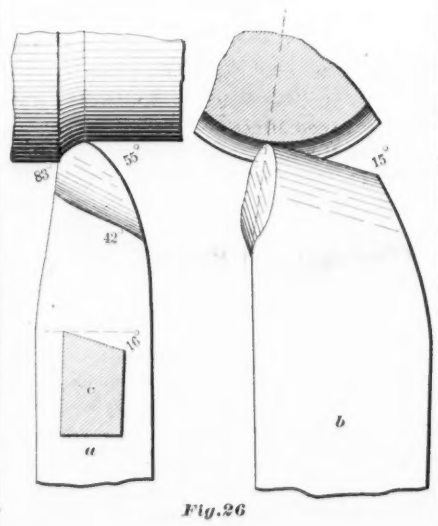


Fig.26

HARTFORD DIAMOND-POINT TOOL.

Speed.	Angle.	Shear.	Elevation.	Feed.	Power.	Condition of Cut.
27.27	90	16	....	68	287.95	Good.
28.39	80	16	....	68	322.75	Broken tool.
28.01	75	16	...	68	243.12	Good.
28.23	70	16	...	68	237.01	Good.
28.23	65	16	....	68	237.01	Fair.
28.23	60	16		68	237.01	Fair.
27.27	55	16	....	68	230.43	Passable.
28.23	50	16	..	68	237.01	Not very good.
28.23	45	16	...	68	237.01	Inferior.
28.23	40	16	....	68	237.01	Slight chatter.
28.23	35	16	....	68	237.01	Bad chatter.
28.23	70	16	10	68	237.01	Good.

The rake is obtained in precisely the same manner with this tool, as with the one shown by Fig. 24. The shear of tool is 22 degrees, but when placed in the tool body, it is reduced to 17 degrees. The clearance is 11 degrees.

The power required to cut off our $\frac{1}{8}''$x$\frac{1}{48}''$ chips with this tool is 239.83 pounds, or 2.82 pounds more than with the diamond point. The shear being 3 degrees less, this loss is easily accounted for.

When this tool is revolved until its angle is 60 degrees, the pull is 239.83 pounds, against 287.95 pounds for the diamond point, Fig. 24, or 312.12 pounds for the diamond point, Figs. 12 and 13, all in the same condition.

Raising the point of this tool 10 degrees, acted precisely as in raising the diamond point; when the axial angle is large, viz.: the pull did not vary from 239.83 pounds.

Dropping point of tool until the body of tool was perpendicular to axis of work, or until the cutting edge was 10 degrees below the centre, the pull was 312.96 pounds, a loss of 73.13 pounds by so doing. This tool now has a tendency to crowd away from the work to a certain extent, and that tendency may be measured by the angle made by the cutting edge of tool, and a line cutting axis of the work.

It is evident that, as this tool crowds off, and that a high-pointed tool draws into the work, there must be a point where a tool would remain still if the tool post were mounted on friction rollers, and were released from the cross-feed screw. This point, or angle, is doubtless the best for accurate work in the lathe, and seems to be the proper one for diamond point or side tools.

The tables give the results of Hartford diamond point and side tool tests, and from these and preceding tables may be deduced the fact that a tool cuts easiest or hardest at axial angles ranging from 35 to 90 degrees, according to the amount of shear given to the tool; also, that with a tool possessing a certain amount of shear, said tool may be revolved through an arc of 55 degrees, without changing the amount of power necessary to force it through the work.

HARTFORD SIDE TOOL.

Speed.	Angle.	Shear.	Elevation.	Feed.	Power.	Condition of Cut.
26.47	90	16	.	68	229.53	Fair.
27.41	60	14	10	68	239.83	Good.
27.41	60	14	....	68	239.83	Good.
25.84	60	15	—10	68	312.42	Fair.
25.84	60	15	—27	68	337.5	Broken chips.
25.84	60	15	— 2	68	300	Good.
25.84	60	15	— 4	68	312.96	Good.
25.84	60	15	— 5	68	318.75	Good.
25.16	90	18	— 5	68	299.20	Good.
25.84	90	18	—24	68	337.5	Hard.
25.84	90	18	—17	68	300	Fair.

A round nose tool, with shear ground up to cut single-handed, makes the best tool for roughing, or for taking heavy cuts to remove a great quantity of metal. The radius of the end of tool must be large enough to exceed the depth of cut, or the same trouble will arise that occurred in using a plain round nose tool with much elevation of point.

The tool shown by Fig. 26 made a cut with 302.78 pounds' pressure, at an angle of 76 degrees. The same tool, set square, or at 90 degrees axial angle, and elevated 15 degrees, made a cut with 285.12 pounds—a gain of 17.66 pounds; by elevating, 15 degrees, the shear being the same in both cases.

The tool in this, and all preceding cuts, reduced the radius of the work $\frac{1}{8}''$; but by rig-

ging up the lead-screw to cut 8 per inch, and rigging gauges on slide-rest and cross feed, the cut was gauged by micrometer to $\frac{1}{68}''$ thick, and a finishing tool $\frac{1}{2}'$ wide was put in the tool post.

In this trial, the same amount of metal was removed, but in a wide, thin chip, instead of a narrow, thick one. The consequence was the dynamometer reading figured the tool to require a pull of 320.6 pounds, or 35.48 pounds in favor of the narrow deep chip.

By gearing the lathe, which had a screw with four threads per inch, with 144 gear on screw and 28 on spindle, and giving a feed of $20\frac{4}{7}$ cuts per inch, the depth of cut was made just deep enough (about .048″) to make up a chip having an area of cross-section equal to the $\frac{1}{8}''$x$\frac{1}{68}''$ chip, taken in the former trials.

The power required under these conditions was only 250.98 pounds, giving a big margin in favor of coarse feeds.

As shown in the table, a test was made without changing the position of the tool, merely changing the chip back to the standard size, $\frac{1}{8}''$x$\frac{1}{68}''$, upon which the power consumed was indicated to be 330.74 lbs.

To reduce $\frac{1}{4}''$ in diameter, a cylinder, 12 inches long, would, with $\frac{1}{68}''$ feed, require 99.27 minutes, and an expenditure of 729,038.88 foot pounds, while, with the square chip, $2\frac{1}{2}$ times run over the work as required, equal to 73.9 minutes and 542,721.6 foot pounds—a saving of nearly 30 per cent. of actual power used, not mentioning power required to overcome lathe friction during the extra time, which will average one half the power consumed in cutting the work; also making a saving of 25.37 minutes, or about one-fourth the time.

From this point alone, the coarse feed is the best, to say nothing of the longer life of the tool while cutting on coarse feeds.

LEFT-HAND ROUND-NOSE TOOL.

Speed.	Angle.	Shear.	Elevation.	Feed.	Power.	Condition of Cut.
26.127	76	13	....	68	302.78	Fair.
26.47	90	15	15	68	285.12	Nice.
25.77	90	15	15	8	320.6	Good.

FINISHING TOOL.

26.29	....	....	....	8	211.06	Good.
25.73	....	....	10	8	303.03	Good.
25.49	....	..	10	8	372	Good.
25.27	....	4	4	20 4-7	250.98	Crumbling.
25.64	....	4	4	68	330.74	Poor.

An attempt was made to carry $\frac{1}{8}''$ feed with $\frac{1}{8}$ chip, in order to make comparison in that condition, but the lathe belt not being power ful enough to drive the lathe with that cut, the attempt was abandoned.

Water Instead of Oil for Dynamos.

A somewhat novel application of water to machinery is made in the basement of the *Globe-Democrat* building, corner of Fourth and Pine streets. Here there are a couple of Edison dynamos, one running 1,300 and the other 1,500 revolutions a minute; and it is upon these machines that Mr. Joe Curtin, foreman, and Mr. Louis Kramer, engineer, have demonstrated that water may be used for other purposes than sailing ships upon. In other words, these gentlemen have shown to their own satisfaction, and likewise to that of curious visitors, that water may be used to advantage in keeping down the temperature of journal boxes, and to the exclusion entirely of friction-easing oils. For over two months now they have been using nothing but water on the journal of the two dynamos, and with the very best results. In comparison with the oil-using period, the pillow blocks exhibit a marked difference when touched by the hand. Formerly they were too hot for anything like continued pressure of the hand, while now they are comparatively cool at all times. The journals also show to greater advantage that brightness of surface denoting friction having given way to a duller and more nearly natural color of metal.

The arrangements for passing the water into the journal boxes are very simple, as is also the method of filtering. First, the water is introduced under hydrant pressure into a filtering barrel, filled with a dozen large sponges. From these it passes into $\frac{1}{4}$-inch pipes, one still under hydrant pressure, directly above each journal box. These pipes have a small cock each at the lower end, from which the water drips rapidly into a brass funnel, inserted in an opening, and leading to the journal. In this way the cooling of the journal is done automatically, and without attention from the engineer or anybody else. The rapid turning of the journals spreads the water in a thin film all around them, and keeps down their temperature to something like that of the filtered water. From the journal boxes the water passes directly to the sewer underneath.—*Age of Steel.*

Next Meeting of the Institute of Mining Engineers.

From a circular issued by Secretary Raymond, we learn that the forty-sixth meeting of the Mining Engineers will be held at St. Louis, Mo., beginning Tuesday, Oct. 12. All communications concerning arrangements, rooms, etc., should be addressed to the secretary of the local committee, Elliott C. Jewett, P. O. Box 576, St. Louis. The office of the local committee, of which Prof. W. B. Potter is chairman, is at 214 Olive street. The hotel headquarters will be at the Southern Hotel.

Fig. 4

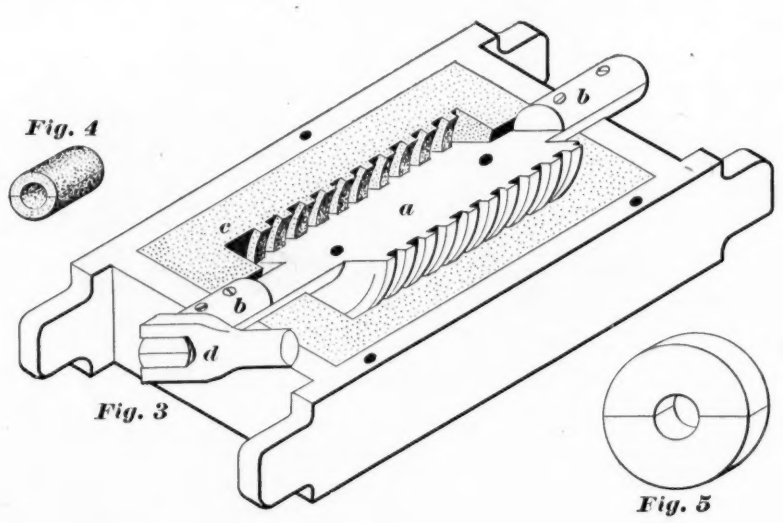


Fig. 3

Fig. 5

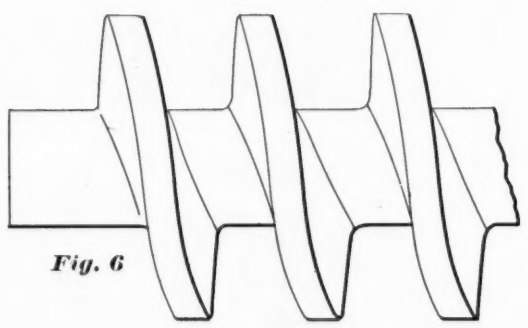


Fig. 6

MOULDING A SCREW.

The following programme is provisionally announced:

Sessions on Tuesday evening and Wednesday morning, afternoon and evening.

Thursday—Excursion to St. Joseph and Desloges Lead Mines and Works, Pilot Knob and Iron Mountain.

Friday—Visit to the Exposition; drive to Cheltenham Smelting and Refining Works and fire-brick manufactories, and to public parks; subscription dinner in the evening.

Saturday—River excursion to Carondelet and Crystal Plate Glass Works, 35 miles from St. Louis.

In addition to these excursions, arrangements will be made for the accommodation of members desiring to visit other places of interest. Particulars will be given in the programme of the local committee.

The Limit of Speed in Ocean Travel.

F. M. F. Cazin contributes a paper to *Van Nostrand's Engineering Magazine*, in which he takes exceptions to recently proposed plans for increasing the speed of Ocean steamships. He concludes as follows:

"I would be much pleased if nautical constructors would deign to take the hint and try the pump once more, but this time taking the water from the ship's front and ejecting it sternward in a straight line in absolute conformity with the intended motion, taking the precaution to take up the water in a narow vertical line at the head, and to eject sternward on as broad a face as practicable, so as to lessen the resistance in the direction of motion, and to increase it where it is contributive to motion. In the method of jet propeller, hitherto exclusively tried, the inlets and outlets were in absolute conflict with the teachings of my new displacement theory.

"'The ship of the next century' need not be, as Prof. Thurston forestalls it, a naval Babylonian tower; but it will be one of rational dimensions, being in harmony with such dimensions as the human race can properly master and control. But 'the ship of the next century' will first apply its motive power in a more rational method than the propeller screw represents. The crank-shaft will be done away with. The water to be moved from head to stern, in order to produce relative motion, will be conducted, not on a circuit around the good ship's body, but right through it lengthwise, in a straight line, and the water rejected at the stern will steer the vessel. And the propelling power will be applied to the screw at its circumference, in place of its center, if a screw be used at all. And in consequence the weight of machinery for exercising the same propelling power will be materially less. And the resistance of the water at the stern being increased, and the resistance at the head being lessened, the same amount of power will produce greater speed. Thus, not a 'Leviathan,' representing increased dimensions, but an 'Investigator,' representing the progress of human thought, will be "the ship of the next century.'"

Fair of the American Institute.

The 55th annual fair of the American Institute will open in New York on the 29th day of September. Workmen are busy putting the building in order. The large central fountain will be in operation this year, illuminated by the Edison electric light. The building is to be lighted by the United States Illuminating Company, with their new arc lights. We are informed that applications for space are coming in with more than usual activity, giving promise of an excellent exhibition. It is expected that the display of steam engines and labor-saving machines will eclipse that of any previous exhibition. The horticultural display will begin on the 6th of October.

LETTERS FROM PRACTICAL MEN.

Moulding a Screw or Worm Without Cores.

Editor American Machinist:

I want to demonstrate that a screw or worm patttern can be successfully made and moulded without the encumbrance of coring. The present sketch, Fig. 3, shows one half of a screw pattern partly drawn from the mould; it will be noticed that the core prints are long and reach outside of the flask; if no prints are needed they can be stopped off, or should a very small core be required, extra cores can be made (as Fig. 4) to fit around the small cores and fill the mould of the prints proper.

It is essential to have the prints on a pattern moulded in this manner sufficiently stiff to secure steadiness in drawing the pattern. The flask is cut out on both ends to fit prints and make proper bearings for them to turn in. As the pattern is a screw and consequently advances one way or the other however it is turned in the monld to extract it, therefore a loose core print (as Fig. 5) is needed, the full diameter of pattern, and thick enough to equal full half the pitch of screw; this print is removed from the mould before the pattern can be started, as seen in Fig. 3. The two pieces *b b*, Fig. 3, are screwed to the prints; when the pattern is ready to draw, one end can be flattened and a piece of wood cut out, as *d*, Fig. 3, for convenience to turn the pattern out of the mould.

It will be plainly seen in the sketch that the pattern rests in its bearings even after it is entirely out of the mould, so the moulder is enabled to turn it easily without jerking, at the same time slightly tapering it. In this manner a screw or worm of almost any form of thread (provided the pattern is properly made and not too long so as to spring in twisting) can be successfully moulded. A pattern like sketch, Fig. 6, has been moulded here without difficulty.

GEORGE ALLGE,
Patternmaker, Colt's Armory.
Hartford, Conn.

Natural Gas in Wheeling.

A good deal of trouble has resulted from the introduction of natural gas. To assist in correcting this and to protect numerous companies the board of underwriters of Wheeling, W. Va., has issued the following memorandum of conditions for the use of natural gas in manufactories:

1. When gas is to be introduced into any premises, a tank governor or regulator shall be placed as remote as possible from the building, by which the pressure shall be reduced to not exceeding two pounds.

2. A safety-valve shall be placed between the governor or regulator and buildings, which will blow off when the pressure exceeds two pounds.

3. A mercury gauge must be placed inside of buildings which will indicate the exact pressure in the pipes.

4. All pipes leading from the regulator and into the mills shall be of as large diameter as possible, and all pipes on entering a building shall be elevated and carried overhead, and above all furnaces and boilers.

5. All pipes, valves and fittings shall be carefully inspected and treated, when the work is completed, by the inspector of the company furnishing the gas, who shall issue a certificate that the equipment is in accordance with the above regulations. The secretary of the board of underwriters on receipt of the inspector's certificate will issue a permit for the use of natural gas, for which he shall charge a fee of one dollar.

The best preparation for a successful master's life is a faithful service, and he who during that time does his duty, acts in every way as if the affairs were his own, and not his master's, and takes a pride in the appearance of the premises, can be certain of being able to fill whatever higher post may fall to his lot competently and well.—*P. H. Marteau in Ironmonger.*

The Valley Steam Pump.

The engravings represent this pump in perspective and section. The sectional cut shows plan of the steam valve seats. At the side are the main and auxiliary valves, and below is the steam end of the pump in section, with valves in position. The arrangement of the steam valves in this pump is such that on simply removing the steam chest, to which no pipes are attached, both main and auxiliary valves can be removed for examination. It will be seen that these valves are simply flat slides, the auxiliary valve having two faces connected by a web, which moves in a groove in the face of the main valve. In the larger pumps, a straight tappett is used to move the auxiliary valve; but in the small sizes, where the stroke is short, and high speed is often used, a swinging lever, as shown in cut herewith, is used, which keeps the auxiliary in motion most of the time.

The manufacturers are the Valley Machine Company, Easthampton, Mass.

Unusual Accumulations in Boilers.

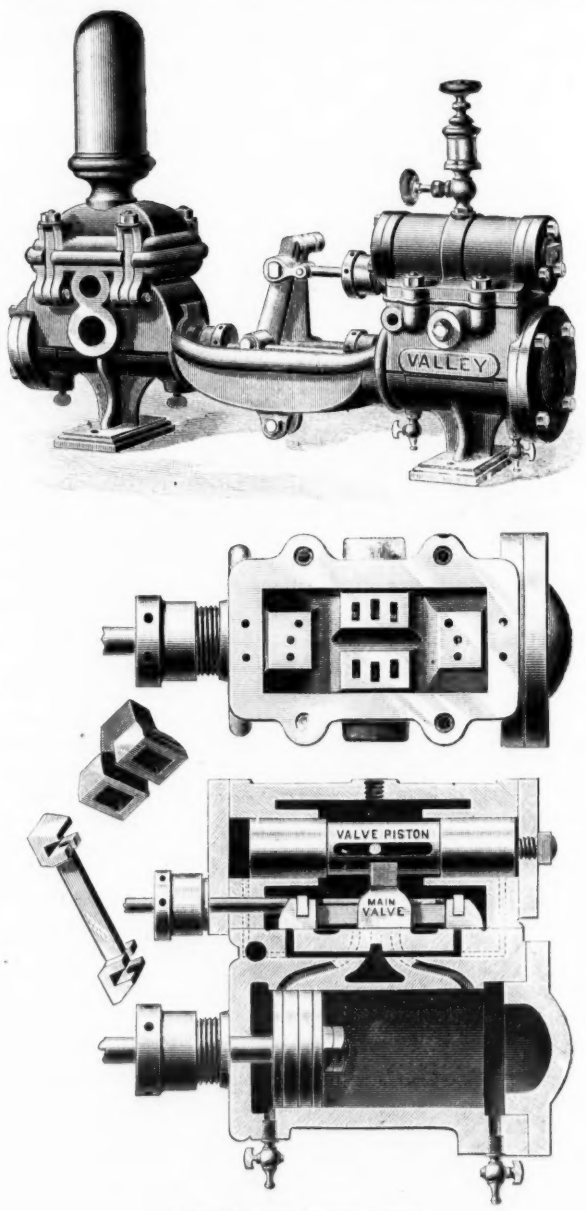
The delay in fitting out the Brooklyn for a cruise on the Asiatic station is explained in reports from the commanding officer and chief engineer received at the Navy Department on August 16. Their account of the condition of the boilers when the vessel returned to the Brooklyn Navy Yard in May last, and of the work performed upon them since that date, shows that they were not in as good condition as reported when the vessel went into commission in October, 1885. Many repairs were made and scale often removed during the eight months' cruise, in spite of which, when the vessel arrived in New York in May last, the boilers showed an unusually large accumulation of scale for so short a cruise. The cleaning resulted in the removal of 27,000 pounds of scale, to which is to be added 4,500 pounds taken out at various times during the cruise. The following rather unusual articles to be found in a steam boiler were also taken out: One working suit, one sledge, four hand lamps, two chisel bars, two scaling hammers, three flat chisels, one piece of $1\frac{1}{4}$-inch pipe and elbow, three wooden wedges, two pieces of board, and one wrench. Some of these articles have been preserved to show the thickness of the scale deposited, and also to figure in the investigation that is likely to be instituted for the purpose of fixing the responsibility for their presence in the boilers. —*Nautical Gazette.*

A Peculiar Narrow-Gauge Railroad.

There is a little narrow-gauge railroad in central Illinois which is rather amusing. It runs through a rich farming country and is owned and managed by wealthy farmers. The conductors, engineers and brakemen are farmers' sons who have grown weary of raising cattle and corn and who have taken to "railroading" as a relief. The various stations along the line of this little railroad are of no consequence whatever, except to their score or more of inhabitants and to the farmers of the neighborhood. A train starts from each end of the road every morning after breakfast, runs to the opposite end of the road by dinner time, returns again for tea and ties up for the night. As there is no telegraph line connected with the road nobody at any of the stations knows when a train is coming until it arrives in sight. As the rails are laid on ties placed on the flat prairie, and as no grade exists from one end of the road to the other, the tall grass has an awkward habit of getting under the wheels and stopping the train. Not infrequently, also the light rails spread apart and the cars run off the track, and go tumbling along on the virgin prairie. Whenever a little accident of this kind occurs the engineer, conductor, brakemen, and passengers jump to the ground and lift the cars into place again. The passengers ride in a car reserved for them in the rear of a long line of freight cars. Half of this car is partitioned off in order that it may also serve for carrying mail bags, express matter and baggage. Not infrequently passengers walk into a village ahead of the train and announce that the cars will follow them in an hour or two, providing they can be kept on the track long enough. Sometimes a locomotive gets stalled on some one of the several gentle hills along the line. The trainmen thereupon quietly wait until the other engine appears. Then the two engines draw the train up the hill. Notwithstanding the oddities which exist in the management of this little railroad it hauls large quantities of freight, and is making money for its stockholders.—*Chicago News.*

Extract from the Address of President Head of the Institution of Mechanical Engineers.

But whilst we, mechanical engineers, have everywhere been guilty of the sin, if it be a sin, of aiding and abetting over production, and thus preparing, as it were, a rod for our own backs, we seem in some things to have been strangely surprised by foreigners. In such cases we are sharing to the full the punishment, without the satisfaction of having partaken in the antecedent gains. Among the few manufactured articles imported largely into this country are clocks and watches. Thirty years ago a good ordinary silver watch



THE VALLEY STEAM PUMP.

of English make cost £6. Within ten years an equally serviceable silver watch began to be sold by the American Waltham Watch Company for under £3. Mr. T. R. Russel, a representative watch maker of Liverpool, who contributed to the Depression of Trade Commission a statement as regards his trade, says that watch making was formerly of special importance in Liverpool. About eighteen hundred operatives were then employed; now there are not two hundred! The bulk of the operatives before dying suffered greatly, and sank in the social scale. Thirty years ago four-fifths of the large number of watches made in Liverpool were exported to the United States. This trade was entirely killed by the increased American tariff, while the home market is now flooded with American and Swiss surplus stocks. This does not matter much to large dealers like Mr. Russell, but he considers it very cruel to the English workmen. He believes that the watch trade in Coventry and in London is a dying industry!

Now, if the Americans prevented us, years ago, from sending our watches to them, by imposing a high import tariff, that was our misfortune, and not our fault. But if with dearer material and dearer labor, and notwithstanding the cost of transit, they can now sell watches in the very heart of England at a lower price than we can produce them for, this must be our fault as well as our misfortune. It would seem a case of over production by foreigners, leaning to under production by ourselves. The Americans appear to have anticipated us in the adoption of various expedients, equally open to ourselves. The Waltham Watch Company is one of comparatively recent origin. The managers began by studying the watch as a piece of mechanism. They selected the best points from every current type, and added some improvements of their own. They found they might safely abandon the complication caused by the fusee and chain, if for the ordinary main spring they substituted one of gradually increasing section, so that it should exert the same force or nearly so, when almost unwound, as when fully wound up. Having settled on a standard type, they determined to adhere to it, and to make certain sizes in it, and no others. They then, at infinite pains, devised or procured the beautiful machinery of which we saw samples at the "Inventories" last year, for making every part in every size. They adopted the plan of having a gigantic factory, with all the benefits of system and concentration, instead of the old English method, under which workmen made the different parts in their own houses, with less machinery, and under circumstances of an altogether less favorable kind. We might have done all this as well as the Americans, but we did not, or at all events not until we had lost much of our trade. We clung to our own old modes and methods, after better ones had been discovered. Everyone knows what an infinite number of sizes and types of English watches there are. Diffusion instead of concentration, adherence to old habits instead of quick appreciation of new and better ones—these are probably the causes which, if Mr. Russell's evidence be correct, have made British watch making now "a dying industry."

But Americans have not been allowed to have it all their own way. The Swiss have long worked on nearly the same system, and they have the advantage of cheaper labor. Formerly their watches were not thought much of in this country, because they were of too flimsy a type and character. Latterly they seem to have improved in this respect, or, at all events, they have studied the requirements of the market, and adapted themselves to it. The price at which they are now producing watches is something marvellous. I recently bought for a schoolboy a substantial new silver watch in a highly-finished case, guaranteed to contain 80 per cent. of metallic silver. The escapement was of the Geneva pattern, the works were electro-gilt, and looked as good as those of any other ordinary watch, and there was a seconds hand, as well as the hour and minute hands. I received a written guarantee under which the seller agreed to do all repairs gratis which might be required within two years, excluding foul play. I wore the watch myself for a fortnight, and during that time it neither gained nor lost a minute, and the total cost was only 18s. 6d.! Surely we are approaching the time when it will be cheaper to buy a new watch than have an old one repaired, and when cases of robbing from the person will be seldom heard of, because watches are no longer worth stealing!

Some sensation was recently caused by the announcement that an American firm of bridge builders had tendered successfully for a large bridge for Australia, against English competition, although the advisors of the purchasing colony were English engineers. It appears that the latter had deviated from the ordinary practice of making designs and inviting tenders for the execution of the work. They had in this case permitted contractors to tender on their own designs. It was under these circumstances that the American firm obtained the contract, after one of their principals had visited the spot and formed his estimate of the cost and risk. Having secured the contract, they sublet a portion of the work in England and another portion in Scotland, thereby obtaining the benefit of more direct and cheaper transit, and cheaper labor and material. Other portions of the structure, for the manufacture of which the contracting firm have special appliances, will be made by them in America, from British material. The ingenuity of bringing to bear in a single undertaking the talent and resources of several countries in this way must command our admiration. But the lowness of price which resulted in success was no doubt largely due to this particular firm of contractors being allowed to tender to a design in the execution of which they had great experience and special facilities. As in the case of watch-making, it is impossible for a manufacturer to produce at his lowest cost for a customer who insists on a special design, made without the same regard to convenience of execution which the manufacturer would keep in view if the design were his own. Had the usual course been here adopted, it would almost certainly have excluded the most favorable tender.

A Good Retort.

A plumber was sent for to the house of a wealthy stockbroker to execute some repairs. He was taken by the butler into the dining-room, and was beginning his work, when the lady of the house entered. "John," said she, with a suspicious glance toward the plumber, "remove the silver from the sideboard and lock it up at once." But the man of lead was in nowise disconcerted. "Tom," said he to his apprentice, who accompanied him, "take my watch and my chain, and these coppers, home to my wife at once. There seem to be dishonest people about this house."—*The American Builder.*

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.
JACKSON BAILEY, Vice-Pres't.
LYCURGUS B. MOORE, Treas. and Sec'y.
96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, Mechanical Engineer.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

SUBSCRIPTION.

$2.50 a year in advance, postage prepaid in the United States and Canada.
$3.50 a year to Foreign Countries, postage prepaid.

ADVERTISING.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, SEPTEMBER 18, 1886.

CONTENTS.

	PAGE
The Hough Automatic Cut-off Engine	1
The Lowe Boiler Furnace	1
Etiquette in a Machine Shop. By Jarno	1
Compound Locomotives	2
Moulding Screw Propellers in Loam. By Chas. A. Devlin	3
Power Absorbed in Cutting Cast-Iron. By Jas. F. Hobart	4, 5
Water Instead of Oil for Dynamos	6
Next Meeting of the Institute of Mining Engineers	6
The Limit of Speed in Ocean Travel	6
Letters from Practical Men—Moulding a Screw or Worm Without Cores. By Geo. Allge	6
Natural Gas in Wheeling	6
The Valley Steam Pump	7
Unusual Accumulations in Boilers	7
A Peculiar Narrow Gauge Railroad	7
Extract from the Address of President Head of the Institution of Mechanical Engineers	7
A Good Retort	7
Convict Labor in Western States	8
"Undesirable Immigrants."	8
Manufacturing Industry at the South	8
Literary Notes	8
Questions and Answers	8
Business Specials	9
Manufactures	9
Machinists' Supplies and Iron	10

Convict Labor in Western States.

In this State there is an avowed intention on the part of favored manufacturers to nullify the clearly defined will of the people, expressed in an overwhelming majority, that the prison contract system should be abolished. Those who are working convicts at wages merely nominal and in direct competition with honest labor can of course afford to spend money liberally to continue the system, and unless there is some united opposition to them they will be very likely to succeed. As the case now stands there is great danger that the wishes of the voters of New York will have but little weight. We do not for a minute believe but that in the end direct competition between convict labor and free industry will be abolished in this State, but the end ought to be now.

However it is in New York, it is a satisfaction to know that, that Western manufacturers are coming to appreciate the evils of prison competition, and are adopting practical means to spread their opinions and to utilize their influence. At Chicago an association was recently formed having for its object hostility to any prison contract system. While this society is not yet large in number, it has in its membership prominent manufacturers from several Western States who will aid its growth by spreading information on the subject. Those manufacturers who are not directly affected by prison labor will come to see that they are indirectly affected by it, and will help along the work of the association.

"Undesirable Immigrants."

Recent events have strengthened the opinion that immigration is going too far for the welfare of the country. We should make more rather than less stringent the limitations of the law.

The above, with the title, we clip from the *Mail and Express*. But few will take exceptions to it. Yet the fact that we have nothing to fear from legitimate immigration, and that we are not suffering from this cause, should not be lost sight of. By legitimate immigration we mean the influx of those who of their own motion, and by their own means, come here to get a better recompense for their labor. Those whose industry at home has furnished them the means to emigrate comfortably, and who do so from intelligent consideration of the subject, always make good citizens. And there is little fear of their coming in excess. The trouble is in the way immigration has been forced here, and emigration forced in Europe. We have emigrants shipped in upon us because it is easier to deport than to maintain them, and this is what the *Mail and Express* complains about. These, as it otherwise points out, do not make a desirable addition to the population. Such laws as we have against pauper immigration, it appears, are not always enforced.

But there are causes that have worked much greater damage than this of pauper emigration. The press of the country for the past twenty years, at least until quite recently, has greatly overstated the advantages of this country. Undoubtedly great as these advantages have been and are, their statement by the press has always been of the spread-eagle character, that was once thought essential to Fourth of July orations. It is little wonder that residents elsewhere, reading these persistent overstatements, come to believe that a man who lacked the energy, the ability, or even the willingness to make a living at home, had only to contrive to get to America to find himself in the way of becoming rich without much work. Recent events show that the number who have come here during the past ten years with this idea pretty firmly impressed on their minds is not small.

Worse than this has been bringing shiploads of emigrants here to work under contract, when their working simply kept others already here idle. Self-respecting, intelligent workmen do not barter themselves away in droves, selling part of their lives to those they bargain with. Such emigration is worse than the pauper emigration against which the *Mail and Express* protests. It has done a good deal towards filling the country, in some places, with what in Europe are termed "dangerous classes." There is at present a law prohibiting contract emigration, but this law appears to be evaded with ease, and curiously enough journals that are considered respectable rejoice in the fact.

The causes above enumerated have worked out their end of bringing more men to this country than there is work for. It is true that there are some of this number who do not want to work, and others whose work is not of much consequence, but aside from these there are more men than there is work.

If emigration had been left to take its natural course—not been overstimulated and forced—the supply would always have equalled the demand, without danger of exceeding it. We should have had most of the desirable additions to our population that we now have, and but a fraction of the undesirable.

James F. Hobart, for the past year connected with the AMERICAN MACHINIST, has severed his connection. He will go to Florida in October, where he will remain through the winter, as correspondent for several trade journals. Mr. Hobart is the possessor of a prospective mine in New Hampshire, from which specimens he has had assayed show a provoking diversity of minerals, with a fair majority in the way of gold. He will do some further boring and drilling before he goes to Florida, with a view to determining whether the mine or journalism is best worth working in the future.

Manufacturing Industry at the South.

The South is making important industrial progress, of which the whole country is justly proud, but it is not wise to over-estimate the effect of this. Doubtless, there are certain conditions favorable to manufacture there that make substantial, if not phenomenal, advance for years to come probable, but it by no means follows that other parts of the country will suffer on account of this. A good deal of iron will be produced at the South, but there is no reason to believe that this means the closing up of profitable mines elsewhere. The chief significance of this is in the fact that more iron will be produced and used in the country than ever before. And so it will be in other industries.

One argument—that is, cheaper labor at the South—will gradually lose its force. As there comes to be large bodies of skilled workmen located there, they will expect, and demand, substantially the same wages as are paid elsewhere. If anything will keep up a permanant difference in wages, it will be that the cost of living is a little less there than in the North and West. But in the end the Southern farmer may be depended upon to base his demands on the demands of those similarly engaged elsewhere. There cannot long be any very marked difference in this respect. There will undoubtedly always be a slight difference in favor of the South as compared with the colder Northern States, especially in rents, and probably in some other things, but against this is the fact that in the colder climate the individual workman is able to do more work in a day. This, we should think, would fairly offset any slight difference in the cost of the necessities of life. So far as concerns most of the so-called luxuries, the advantages would appear to be about evenly balanced.

There is nothing in industrial progress at the South, remarkable as it has been, that is likely to call forth the jealousy of any other section of the country. Thus far it has only helped to enrich the whole country, and will undoubtedly continue to do so. This progress seems more remarkable to those who in the past have had few means of observing such progress. To them the progress taken as a matter of course in the older manufacturing centers would appear remarkable if the same chances for observation were at hand. Take the city of New York, for instance, the largest manufacturing city in the country, and, while it is known, in a general way, that there is constant and great progress, not one in ten thousand of the citizens ever give it a thought.

The development of the natural resources of the South is something in every way to be desired. It means spending more money at home and less abroad. Nothing is so likely to permanently check this development as placing too much dependence on assumed natural advantages. It is universally found that such advantages are in part, or wholly, balanced by those of some other kinds peculiar to other locations.

The decision of the treasury department that patterns from which castings are to be made are not entitled to entry free of duty, as models, is only what a common sense interpretation of the matter would lead anyone to expect. The necessary patterns are only a part of the construction of the machine, not, as in the case of the model, something to show how the machine should be constructed. Frequently the construction of the necessary patterns is a large part of the total cost of a machine, and it is not clear why it should ever have been assumed that they were not dutiable.

Our enterprising contemporary, the *Northwestern Lumberman*, finds itself unwillingly engaged as complainant in a lawsuit to protect its title. The facts as set forth in the brief are that the title was established in 1874, the word Lumberman having never been applied to any journal devoted to the lumber trade, and that the paper soon came to be known and spoken of as the Lumberman. Recently another paper has been started under the title of *The Lumberman*. Of this the proprietors of the *Northwestern Lumberman* justly complain, and there seems no reason to doubt that they will win their case.

Not infrequently readers of technical papers or books complain that articles are written in a style rather above their comprehension. It is a question if this is not sometimes a merit. If a reader is interested in the subject he will be very likely to study those parts that he does not comprehend until he understands them, and in doing this he will learn something he did not know before. Technical writers, however plain they may write, can hardly help using terms not understood by those unacquainted with the subject. This is sometimes valuable in pointing out a reader's deficiency.

The cutting-off machine is, amongst the list of modern machine tools, one that is not appreciated at its full value. There are hundreds of machine shops in the country where round stock is still cut up in the "good old way," in which a cutting off machine would save its cost twice a year.

Literary Notes.

E. & F. N. Spon, 35 Murray street, N. Y., have issued a neat catalogue of 112 pages, containing a list and description of their books relating to applied science. For mechanics, manufacturers and scientific amateurs, this catalogue will be very useful.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(331) R. D., Norfolk, Va., asks: 1. In what direction is science looking with any chance of success for motive power that will take the place of steam? *A.*—In no direction. 2. What difficulty is there in the way of preventing the oscillating engine from successfully competing with other engines? *A.* The difficulties are of a mechanical nature, such as packing, oval wearing of cylinder, unnecessary motion of large mass of metal, etc. 3. What should be the dimensions of ports for an engine 2⅛″x4″ for highest speed practicable? *A.*

Highest speed practicable is indefinite. For 500 feet piston speed the area of port should be about 1-10 piston area. 4. How much should the lap be, and what the diameter of crank-pin? *A.*—This depends upon conditions which you do not state. Answers to such questions come under the head of design, which must be to a certain determined end. 5. Do you think it utterly impossible to construct a perfect rotary engine? *A.*—Yes.

(332) J. B., Jersey City, N. J., asks: What pull, in pounds, will be required to slide a cast-iron block weighing 155,480 lbs. on wrought-iron bars? *A.*—The coefficient of friction for cast iron on wrought iron, ample bearing surface, well lubricated with lard, is given at about .07 while under motion, and .12 while at rest. According to this it would take a pull of 18,657 lbs. to start the block, and 10,883 lbs. to keep it moving.

(333) W. M., Buffalo, N. Y., asks: In laying out the key-way in a crosshead, should the hole through crosshead be parallel and the taper be on one side of key-way in piston-rod, or should the key-way in rod be parallel and the taper be in the key-way through the crosshead? *A.*—The common practice is to taper the key-way in both crosshead and rod so that the center line of the key will be at right angles to the rod. 2. How can I approximate the pressure above atmosphere of the steam that is exhausted from the high-pressure cylinder of a compound engine? For instance, the cylinders of a steeple compound engine are 20″ and 40″, by 42″ stroke; boiler pressure, 100 lbs.; cut-off in high-pressure cylinder at 10 inches. I want to approximate the pressure when it gets to the low-pressure cylinder. *A.*—Adding the atmosphere—say 15 lbs.—to the steam pressure, and you have for pressure at the end of stroke of high-pressure piston

$$115\times\frac{10}{42}=27 \text{ lbs.}$$

absolute. Subtracting the pressure of atmosphere gives 12 lbs. pressure above the atmosphere. This is only an approximation, because on one hand you will not have a pressure of 100 lbs. at cut-off, and on the other the clearance space will add something to the volume. You can, as has been done above, guess that one of these will balance the other. It may or may not, according to construction. There will be a fall of pressure between the two cylinders, so that under the conditions named, it is not probable that the pressure in the low-pressure cylinder at the commencement of its stroke will be more than three or four pounds above atmosphere.

(334) J. U., Tarentum, Pa., asks: 1. I have a small engine 2¼″×4¼″, running 400 revolutions, with 40 lbs. boiler pressure. The steam ports are 5-16″×1¼″; exhaust port, ¼″×1¼″. What power should I get? *A.*—If construction is otherwise good, you may get from one to one and one-half horse-power. 2. I have a horizontal boiler, 21″ diameter and 31 inches long, with a 6″ return flue. The furnace is 12″×16″×16″; depth of ash pit, 16″. The boiler does not make steam enough for the engine. What can I do to improve it? *A.*—Your boiler is much too short, and this defect is aggravated by the use of a large tube. As it is, we do not see that you can do anything to improve it, except to put in new heads and smaller tubes. You could probably find room for sixteen two-inch tubes, which would nearly double the heating surface. While you were doing this, if you would make the boiler twice its present length, you would still further improve it.

(335) B. M., Foxboro, Pa., asks: Has the scheme for issuing $1 patents, noticed in the AMERICAN MACHINIST of Dec. 19, 1885, ever gone into effect? *A.*—No.

(336) L. R., Norwalk, Conn., asks: What should be the area of foot valve for a jet air pump 12″ diameter, 75 revolutions, and how is the upper valve arranged when the floating top is used? *A.*—According to Haswell, the area of foot valve should be three-quarters that of the air pump. When the floating top is used the top itself is the upper valve, lifting or "floating" to let the water pass. We should not advise you to use the floating top. It will not be tight and will give you trouble at that speed. If a valve directly over pump is necessary, put on a grating and use valves same as you use in the piston.

(337) W. M., New Orleans, La., writes: I am a boy 15 years old. I have been to school 8 months, and I think I have learned very well for the time. I have a choice of two trades, one that of engineer, the other that of blacksmith. I want to ask: 1. Which trade should I go to? *A.*—Your letter shows that you have made excellent advances in the short school opportunities you have had. First of all, we should advise that you do not give up regular study because you cannot go to school longer. You can learn just about as well at home. Take up your studies where you left off at school, and stick to them. As regards the two trades or occupations you mention, there is but little choice. Our advice is that you take the one in which you feel the most interest. 2. Are there any books that will help me in learning to become an engineer, that is, if you think me capable of learning? *A.*—We think you are capable of learning anything, if you decide to work for it. Whether you take up engineering or blacksmithing, we advise that yon get some work on natural philosophy and study it thoroughly. You can find such a work at any store where school books are sold. After you have mastered this, if you have any doubts as to what you should study, we shall be glad to hear from you.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Patent Att'y, H. W. T. Jenner, Washington, D. C.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Korting Exhaust Steam Condenser. Send for descriptive catalogue K. A. Aller, 109 Liberty st., N.Y.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

The best engine for all purposes made by the Washburn Engine Co., Medina, Ohio.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

20″, 25,″ 28″ B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The best wire nail and tack and nail machinery. Wm. A. Sweetser, Brockton, Mass.

20,000 addresses of steam users and users of mach. in 10 States, $10. J. N. Mills Pub. Co., 30 Vesey st., N.Y.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 93 John st., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Best Return Steam Traps, Pressure Regulators Positive-Acting Pump Governors, Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Machinists' supplies, brass goods, m'f'rs supplies, polishing materials, shafting, light mach'y., etc; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

Curtis Pressure Regulators, Curtis Return Trap. Curtis Damper Regulator. See Sept. 4, p. 10. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Infringement of patent—Suit pending against mfr. imitation "Eureka" Packing. Dealers just as liable as mfr. Get genuine, with red label, from Hine & Robertson, 12 Cortlandt st., N. Y.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15, Astor Place, New York.

MANUFACTURES

The Pocassett mill at Fall River, Mass., is to be refitted.

Cyrus Leighton, Berlin Falls, N. H., is building a blacksmith shop.

Warren Morton will establish an electric light plant at Cedar Key, Fla.

H. P. Frost will establish a dynamo machinery factory at New Haven, Conn.

The Palmer Wire Co., Palmer, Mass., is adding new machinery to their plant.

J. H. Smith will build a two-story brick mill at Blanchardville, Palmer, Mass.

The manufacture of steel is to be introduced by the Knoxville (Tenn.) Iron Works.

The Rome Electric Light Company, Rome, Ga., has been organized.

A rolling mill is being built by Cherry, Morrow & Co., at Nashville, Tenn.

Cron, Kills & Co., Piqua, Ohio, are building a new factory 150x50, three stories high.

The Swift Manufacturing Co., Columbus, Ga., will add 25 new (cotton) looms.

A new foundry is being built by the Flint & Walling Manufacturing Co., of Kendallville, Ky.

Tanner & Lancaster, of Spartansburgh, S. C., will soon open a lath, door, sash and blind factory.

The Old Dominion Iron and Nail Works, of Richmond, Va., are putting in a Bessemer steel plant.

The Lake Shore Foundry Co., are building new works at Cleveland, Ohio, to employ 250 workmen.

The Crystal Shear Company, Southington, Conn., are building an addition to their foundry.

R. B. Wigton & Sons, of Bellefonte, Pa., contemplate the erection of a new furnace near Gatesburg, N. Y.

The Frobes Frochilic Stationary Engine Company has been incorporated in Chicago, with a capital of $300,000.

Newark Electric Light Company, 810 Broad street, Newark, N. J., will erect a two-story brick machine shop.

The citizens of Calais, Me., have subscribed $35,000 towards a large shoe manufactory at that place.

The Converse Toy and Wooden Company, Winchendon, Mass., will build a three-story and basement factory.

New stove works, 175x300 feet, are being erected by the Baxter Stove and Manufacturing Company, of Birmingham, Ala.

The Brooks Locomotive Works, Dunkirk, N. Y., are building 20 locomotives for the Chicago, Kansas & Nebraska railroad.

The Dwight Company, Chicopee, Mass., will increase their capacity by the addition of more textile machinery.

A new boiler shop is being erected at the Brooks Locomotive Works, at Dunkirk, N. Y., and other new shops are contemplated.

The St. Louis Steam Heating and Ventilating Company are enlarging their shops and making additions to their machinery.

The David Brodley Manufacturing Company, Chicago, are completing a factory for building square corner sulky and gang plows.

A complete outfit of machinery has been shipped to the new machine shops of the Somersworth Machine Company, Dover, N. H.

The city council, Harper, Kansas, are contemplating the erection of water-works. New works have also been incorporated at Lawrence Kansas.

The Somersworth Machine Company, Great Falls, N. H., will soon move to its new shops at Dover, where the new works will accommodate 200 hands.

Ferdinand B. Smith's novelty force pump shops, at Canton, Ohio, have been damaged by fire to the extent of $8,000. Will be rebuilt as soon as possible.

The Wainwright Manufacturing Co., Boston, Mass., are putting up an addition to their factory of 31x78 feet. They manufacture feed-water heaters, radiators, etc.

The Porter Manufacturing Company, Pittsburgh, have several foreign orders for their light locomotives. Among them is one from Yucatan, two for Venezuela, and for the United States of Columbia.

Burrell & Whitman, manufacturers of dairy apparatus and agricultural implements, are building works at Poughkeepsie, N. Y., to which place they will move from Little Falls. The machine shop will be 57x127 feet; foundry, 37x100 feet.

The Pond Engineering Co., St. Louis, have been awarded the contract for the pumping machinery for the water-works at Sioux Falls, Dakota, consisting of a Blake duplex pumping engine of 1,000,000 gallons capacity, together with boilers, etc.

The Detroit (Mich.) Blower Co. has recently constructed for the Pullman Palace Car Company a blower for their lumber-drying plant, which will deliver nearly 80,000,000 cubic feet of air every 24 hours. The weight of the blower is 5,540 lbs., the wheel alone weighing 1,000 lbs.

John L. McMillan, of Ilion, N. Y., has, according to the *Ilion Citizen*, perfected a type-stting machine that does the work of several men in an entirely satisfactory manner. The *Gazette* felicitates itself upon being the first paper ever printed by electricity and from machine-set type.

McLean Bros. & Rigg, hardware and general merchants of Melbourne, Sidney and Adelaide, Australia, have just opened an office at 52 and 54 New street, New York, where they purpose dealing direct with their Australian houses in the same way that their London office has heretofore done.

The Iowa Iron and Brass Works is the name of a new firm just started in Des Moines, Iowa. They will build small engines from ⅛ to ⅓ horse-power, or will sell the castings; also design and build special machinery, rebuild and repair printing machinery, do plating, furnish brass castings and rolled brass, etc.

The firm of G. A. Gray, Jr. & Co., Cincinnati, O., have incorporated with the name "G. A. Gray Co.," and have moved into a new building northwest corner of Sycamore and Webster streets. They are increasing their plant about double, and will continue the manufacture of machine tools. Business has been very active with them for more than a year, and prospects are good for the future.

Winslow Allderdice has perfected a machine for finishing tubing, inside and out, the finish being similar to that of "cold calendered" shafting, and has organized a company with $200,000 capital stock, to manufacture the same. Attracted by the superior shipping facilities and numerous building sites of Warren, Ohio, representatives of the company visited that city, and having selected a site to suit them, were presented with the eight acres of land and $15,000 in cash, which they asked, from the citizens. They expect to begin erection of buildings at once.

The Ohio Falls Car Works, at Jeffersonville, Ind., recently resumed operations after several years of idleness. Mr. Sprague, who has returned from Europe, was re-elected president, and Mr. J. L. Smyser vice-president. The shops and tracks have been overhauled and full forces are working on a number of their standard coaches. The company have just contracted for 200 freight cars for the St. Louis Air Line, which will start the works up in full operation, thus giving steady work to hundreds of workmen. The car works have not been running on account of low prices, uncertain labor and general depression of business.—*Iron Age.*

J. Batchelder & Co., Barre, Vt., have leased a large mill building, and will put in polishing machinery.

During the month of August the Babcock & Wilcox Co. have placed the following boilers: New York Steam Co., N. Y., (12th order), 1,750 H.P.; Young & Farrell, Chicago, Ill., (3d order), 82 H.P.; Lawrence Rope Works, Brooklyn, (2d order), 125 H. P.; Grand Avenue Cable Road, Kansas City, 600 H.P.; Swift Mfg. Co., Columbus, Ga., (2d order), 75 H.P.; Albaitero y Arrache, City of Mexico, 184 H.P.; Thompson Bros., Philadelphia, 15 H.P.; F. P. Holt, Laconia, N. H., 75 H.P.; New York Steam Co., N. Y., (13th order), 1,000 H.P.

The Abendroth & Root Co. have in course of construction and erection at the present time, their new "C" boiler, as follows: Denison Water-works, Denison, Texas, 200 H.P.; Peabody Hotel, Memphis, Tenn., 80 H.P.; Hackettstown Collegiate Institute, Hackettstown, N. J., 90 H. P.; Thomas Terry & Co., Cienfuegos, Cuba (2d order), 471 H.P.; Amatz La Guardia, Havana, Cuba, (2d order), 308 H.P.; Pioneer Iron Works for Cuba, (3d order), 310 H.P.; American Dairy Salt Co., Syracuse, N. Y., 155 H.P.; Sweet Mfg. Co., Syracuse, N. Y., (2d order) 200 H.P.; Duncan Salt Co., Silver Springs, N. Y., 200 H.P.; Lackawanna Salt Co., Mt. Morris, N. Y., 138 H. P. Edison Electric Light Co., Cincinnati, Ohio, 200 H.P. Union Steel Screw Co., Cleveland, Ohio, 175 H. P.

The new mill of the Lonsdale Company, at Lonsdale, R. I., is going up on the Whipple estate, so called. The main building will be four floors in height, 686 feet long and 101 feet wide. The weaving shed will be 120 feet in width, and will be partly one and partly two floors in height. The capacity of the mill will be about 65,000 spindles, affording employment to nearly 800 hands. The work of laying the 5,000,000 brick required for the structure began last month, and by Christmas it is expected that the mill will be covered in. The motive power for the machinery will be entirely that of steam. A pair of Corliss compound engines have been contracted for, having unitedly 1,300 horse-power.

The Lauth method of rolling nail plate from old steel rails continues satisfactorily at the works of the Bellefonte Iron and Nail Co., Bellefonte, Pa., where it can be seen in daily working. The method is so simple that few can appreciate its merits on a mere statement. A piece of old rail of proper length is given two passes through roughing rolls, which partly reduce the head and flange, without lapping the latter. It is then given a sufficient number of passes, crosswise, to widen it to 13″, which is done in chilled rolls (Lauth, three-high, having a small roll in the middle). After this it is given three final passes lengthwise in the same rolls, and the plate is finished. The question as to quality of product made from old rails has been satisfactorily settled, and by the purchasers themselves. At this writing, altogether, 2,000 tons of nails have been produced. The Bellefonte Iron and Nail Company use it; a number of other parties are about to adopt it. The latter company control the patent.—*American Manufacturer.*

A Bristol, R. I., firm, manufacturing a patent pump, has leased the second floor of the machine shops at the Fair Haven Iron Works, and carpenters are making alterations. The iron works machinery has been moved to the lower floor, and the pump company will put in its own machinery. The plant will probably not be in operation before the last of next month. Plans have been completed by Mr. J. B. Woodworth, for a pumping station for the towns of Arlington and Rockland, Mass. This station will consist of an engine house, 32x41 feet; a boiler house, 23x37; a coal house, 16x13; a chimney, 9x9 at the base and 85 feet high above the engine room, and a cottage house for the engineer. The directors of the Greylock Mfg. Co., North Adams, Mass., have decided to enlarge their mill by building a warping and beaming room, 100x50, and they will build a new dye house and make other improvements. It is now stated that the Old Colony Railroad Company has purchased extensive tracts of land in Braintree, Mass., upon which to erect the repair shops which it was thought were to be located at Taunton.—*Commercial Bulletin.*

F. W. Titcomb, of Houlton, Me., has lost three steam saw-mills by fire dur ng the last three years. Undaunted by these heavy losses Mr. Titcomb is now building in Houlton one of the finest steam-mills in Aroostook county. The main mill is 100x50 feet, with one wing 75x30, and engine room 40x20. The boiler room will be of brick, 30x18, and separated from the mill by a brick partition. It will contain four boilers, and the fuel will consist of the sawdust, which will be conveyed direct to the furnaces by belts from the various parts of the mill. The buildings have just been shingled, and now Mr. Titcomb will cover the entire roof with gravel and tar. The machinery for the mill will consist of three shingle machines, a double rotary, parallel gang edger, large eight rolled four-sided planer, clapboard machine, gang lathe machine, clapboard planer, a machine for taking the bark off from shingle bolts and other machinery. Mr. Titcomb will soon build a dry-house near by. He will manufacture hardwood flooring, shingles, long and short lumber, etc. The total expense of this mill, with machinery, will be about $50,000. It will be ready to start up in three weeks. As a safeguard against fire, the Holly water will be introduced into the mill, and 1,000 feet of perforated piping will be distributed through the mill and on the roof, so that in case of fire the building can be wet down at once, and during the summer months Mr. Titcomb will by this arrangement wet down his mill every day.—*Industrial Journal.*

Machinists' Supplies and Iron.

NEW YORK, Sept. 2, 1886.

There is nothing new to note in the way of manufacturing and the supply trade.

Iron—The demand for American pig remains unchanged. Quotations for Standard brands are: No. 1 X, $18 to $18.50; No. 2 X, $17 to $17.50.

Scotch Pig—Quotations: Coltness, $20; Glengarnock, $19; Gartsherrie, $19.50; Summerlee, $19.50; Eglinton $17.50 to $18; Langloan, $19.50.

Lead—4.75c.

Antimony—Hallett's, 7.70c.; Cookson's, 9c.

Copper—The market continues firm. Lake has sold at 10.30c.

Spelter—Refined, 5¾c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted — Young, first-class machinist blacksmith; apply at once. Jos. Crossley, Trenton, N. J.

Situation Wanted—First-class machine patternmaker. Address 44 South Ave., Bridgeport, Conn.

Scale and beam-makers wanted. Riehle Bros., 9th and Master sts., Philadelphia, Pa.

Wanted—Position as foreman, by an experienced boiler shop foreman. Address Foreman, AM. MACHINIST.

Wanted—A good assistant draftsman who has had some shop experience. Apply at 35 Broadway, Room 88, New York.

Wanted—Situation by a tool-maker, where he can have steady work; references given. Address E, 28 Florence street, Springfield, Mass.

Wanted—A first-class foreman for a machine shop; must thoroughly understand the manufacturing of stationary engines and general machine work. Address immediately, giving age, experience and references, J. D. Green, Oswego, N. Y.

Mechanical engineer and draftsman, with eleven years' practical experience in designing and construction, is open for engagement; correspondence solicited; references given. Address Mechanical Engineer, AM. MACHINIST.

Wanted—Foundry foreman; one of experience in large engine work; must be thoroughly competent in the work and the handling of men; must be strictly temperate; to the right man steady work with fair salary will be given. Address, with references and experience, H. O. R. Co., AM. MACHINIST.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Gerlach's Engineers' Specialties beat the world. Send for price list. Crescent Mfg. Co., Cleveland, O.

Crescent grease cup for shafting beats them all. Sample free. Crescent Mfg. Co., Cleveland, Ohio.

Steel stamps, stencils, burning brands, and brass checks. T. M. Parker, Hartford, Conn.

Light mach'y of all kinds built at short notice. Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

Wanted—A party to manufacture the bench hook illustrated in this paper Sept. 4, or will sell the patent reasonable. J. B. Boyce, Lockport, N. Y.

John Lamberty, mfr. telegraph and electrical instruments, experimental machs, models; fine gear cutting a specialty. 35 S. 5th st., Br'kl'n, E.D., N.Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

Send for estimates of high-speed compound enginss for stationary and marine service. Crist Engine Works, 140 Baxter street, N. Y.

Experimental and new machinery for special purposes built by contract from specifications and inventors' designs; ample facilities. Cohoes Iron Foundry and Machine Co., Cohoes, N. Y.

Partner Wanted—A mechanic with $5,000 to invest in the manufacture of light machinery for New York, will find it to his advantage to correspond with advertiser. Address Box 2, AM. MACHINIST.

For Sale—A well established foundry and machine shop, including lots, buildings, machinery, patterns, and stock on hand, situated in Logan, Hocking Co., Ohio; will sell on easy and satisfactory terms; reason for selling—old age and ill health. Apply to R. Belt, Logan, Ohio.

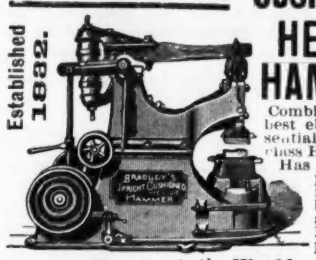
M. Martin, manufacturer. P. O. Box 285, New Brunswick, N. J., will contract for the manufacture of articles in brass and other metals (stamped or turned), and dies and tools for making same; also patent novelties, electrical inventions, special machinery castings, etc.; estimates cheerfully given.

Alfred Dolge (Felt. Dept.), Dolgeville, N. Y., writes to T. R. Almond, 83 and 85 Washington st., Brooklyn, N. Y. "Your Almond Couplings are doing splendid work. I have used two for months, to the satisfaction of every one in my mills. Am putting up the third one now, and certainly give them the preference over beveled gears."

For Sale—A first-class foundry and machine shop; large connection in saw-mill county in the South, including buildings, lots, machinery, and will supply stock on hand; business will be carried on until sold; reason for selling, retiring from business; apply at or address Southern Foundry, AM. MACHINIST.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1832.



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

BRADLEY & CO. Syracuse, N.Y.

Business Opportunity.

TO LEASE or FOR SALE. Machine shop and foundry paying large profits. Shops Leadville, Colo. Address,

A. FALKENAU,
Care of DICKSON MFG. CO.
SCRANTON, PA.

WATER WORKS MACHINERY A SPECIALTY.

Cor'sp'd'ce Solicited. **POND ENGINEERING CO.** St. Louis, Mo.

BEAUDRY'S UPRIGHT CUSHIONED POWER HAMMER

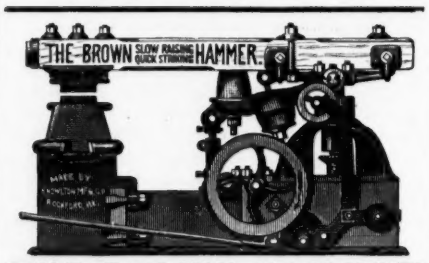
The success of our Machine is the best guarantee of its value. Only machine with Double Helve. Does more and better work with less repairs than any other.

BEAUDRY & CUNNINGHAM, Boston, Mass.

STEPHENS VISES. PATENT

50 Per Cent of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the Improved Taper, Pipe and other attachments. Sold by the trade. Send for circular.

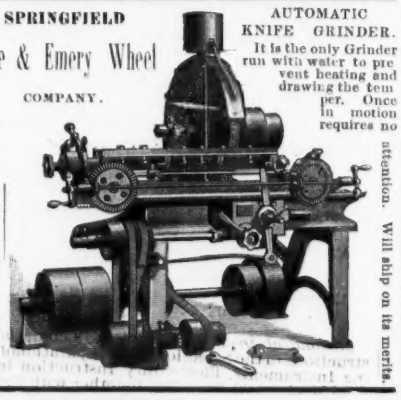
MELVIN STEPHENS, Prop'r.
Office, 41 Dey Street, New York.



THE BROWN HAMMER
STRIKES A BLOW WITH
Double the Velocity That it Raises the Hammer.
A NEW MOVEMENT! SEND FOR DESCRIPTION.
Knowlton Mfg. Co., King St., Rockford, Ill.

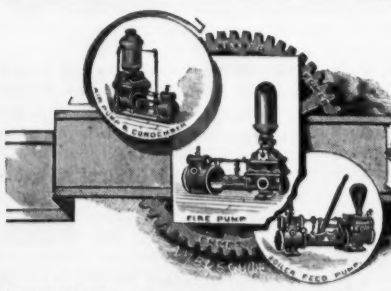
SPRINGFIELD
Glue & Emery Wheel
COMPANY.
Springfield, Mass.

AUTOMATIC KNIFE GRINDER.



It is the only Grinder run with water to prevent heating and drawing the temper. Once in motion requires no attention. Will ship on its merits.

KNOWLES Steam Pump Works.

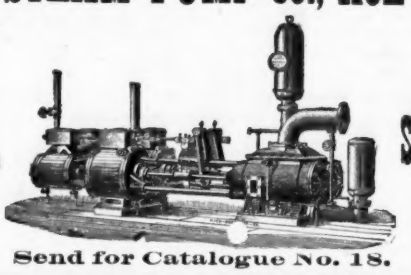


93 Liberty St. NEW YORK. | 44 Washington St. BOSTON.

IMPROVED PUMPING MACHINERY For Every Class of Work | SEND FOR NEW ILLUSTRATED **CATALOGUE.**

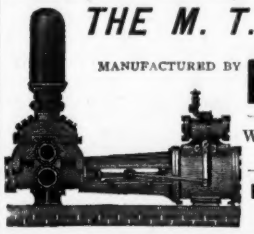
THE DEANE STEAM PUMP CO., HOLYOKE, MASS.

BUILD WATER WORKS, ENGINES AND STEAM PUMPING MACHINERY.



Send for Catalogue No. 18.

THE M. T. DAVIDSON IMPROVED STEAM PUMP.



MANUFACTURED BY **DAVIDSON STEAM PUMP COMPANY.**

WARRANTED THE **BEST PUMP** MADE FOR ALL SITUATIONS.

PRINCIPAL OFFICE, No. 77 LIBERTY STREET, N. Y.
NEW ENGLAND OFFICE, 51 OLIVER STREET, BOSTON, MASS.

THE **HENDEY MACHINE COMPANY.**
MANUFACTURERS OF
TORRINGTON, CT.
SEND FOR CATALOGUE
Machinists' Tools, LATHES, PLANERS, SHAPERS, DRILLS, ETC., ETC.

H.W. JOHNS' ASBESTOS PLASTIC STOVE-LINING.

Has proven one of the most desirable articles for the household ever produced It is put up in neat and convenient packages ready for use, and can be easily applied by anyone at less than one half the expense of common brick linings, while it is far more durable. Only about one half the thickness of ordinary fire brick is required, leaving a larger space for fuel. It is suitable for all sizes of Stoves, Ranges and Furnaces and is also largely used by manufacturers.

SPECIAL INDUCEMENTS TO THE TRADE.

H. W. JOHNS MANUFACTURING CO.
Sole Manufacturers of
H. W. JOHNS' ASBESTOS LIQUID PAINTS. ASBESTOS ROOFING, STEAM-PIPE AND BOILER COVERINGS, STEAM PACKINGS, FIRE AND WATER PROOF SHEATHING, ETC.
87 MAIDEN LANE, NEW YORK.
CHICAGO—PHILADELPHIA—LONDON.

FOR SALE Foundry and Machine Shops, in a good town having three railways. Shops doing good business. For particulars address, YOUNG & CO., Kokomo, Ind.

TO INVENTORS AND MANUFACTURERS

The Fifty-Fifth Annual Exhibition of the
AMERICAN INSTITUTE
OF THE CITY OF NEW YORK
will open September 29, 1886. Heavy machinery will be received as early as September 15th. Intending exhibitors must make early application to secure proper space and classification. For blanks and information, address
GENERAL SUPERINTENDENT,
American Institute, New York City.

OIL CUPS

For Engines, Shafting, &c.
Illustrated Catalogue Free.
J. E. LONERGAN & CO.
Philadelphia, Penna.

STEWART'S READY ROOFING PATENT

For ROOFS OF ALL DESCRIPTIONS, steep or flat, can be applied by ordinary workmen having no previous experience. Send for Samples and Illustrated Pamphlet. Address
W. H. STEWART,
74 Cortlandt Street, New York.
IRON FIBRE PAINT, for Roofs and Factory and Farm Buildings.

COOKE & CO., DEALERS IN
Machinery and Supplies,
22 CORTLANDT ST., NEW YORK.
AGENTS FOR

The Waters Perfect Governor.

Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also,

SUPPLIES

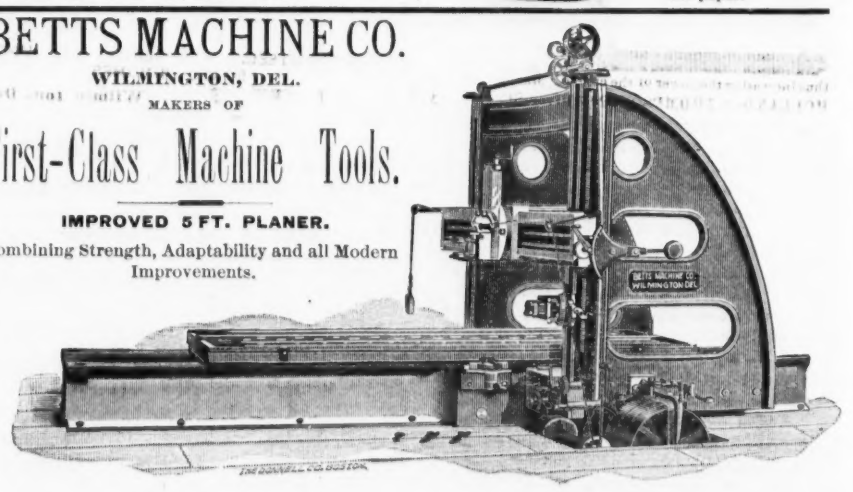
For Machinists, Railways, Mills, Mines, Etc.

Please send for circular and state that you saw the advertisement in this paper.

BETTS MACHINE CO.
WILMINGTON, DEL.
MAKERS OF
First-Class Machine Tools.

IMPROVED 5 FT. PLANER.

Combining Strength, Adaptability and all Modern Improvements.



NICHOLSON FILE CO.,

SOLE MANUFACTURERS OF

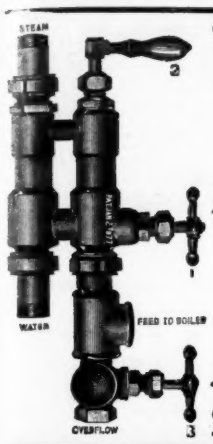
FILES AND RASPS

HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS AND SPECIALTIES.

Nicholson File Co.'s Files and Rasps, "Double Ender" Saw Files, "Slim" Saw Files, "Racer" Horse Rasps, Handled Rifflers, Machinists' Scrapers, File Brushes, File Cards, Surface File Holders, Vise File Holders, Stub Files and Holders, Improved Butchers' Steels.

Manufactory and Office at PROVIDENCE, R. I., U. S. A.



THE HANCOCK INSPIRATOR.

THE STANDARD

BOILER FEEDER FOR ALL CLASSES OF BOILERS.

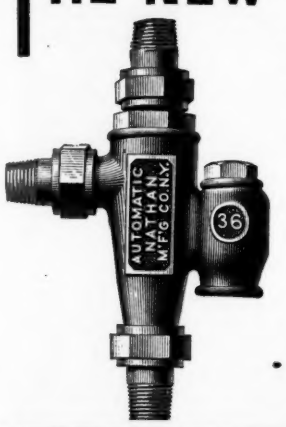
OVER 85,000 IN USE.

Send for Circulars and price Lists.

THE HANCOCK INSPIRATOR CO.

OFFICE, 33 INDIA WHARF, BOSTON, MASS.

THE NEW "GRESHAM" PATENT AUTOMATIC RE-STARTING INJECTOR



"Invaluable for use in Traction, Farm, Portable Marine and Stationary Boilers of all kinds. No handles required. Water supply very difficult to break. Capability of restarting automatically, immediately after interruption to feed from any cause."

SEND FOR CATALOGUE. RELIABLE AND CHEAP.

Sole Manufacturers in the United States & Canada,

NATHAN MANUFACTURING CO.

92 & 94 LIBERTY ST., NEW YORK.

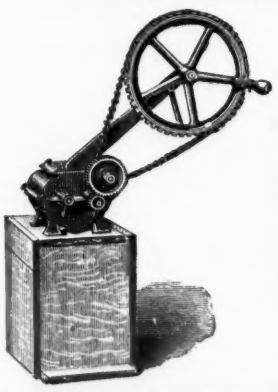
Established in 1874.

CLEVELAND TWIST DRILL CO.

21 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

ROOTS' NEW ACME HAND-BLOWER.

For Blacksmiths, etc. Slow Speed. Positive Blast. Is Durable Compact and Cheap, also Portable Forges, Tuyere Irons and Foundry Blowers.



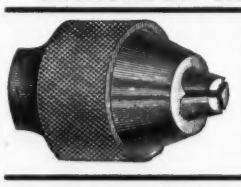
P. H & F. M. ROOTS, Mfrs.
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., } 22 CORTLANDT ST., NEW YORK.
COOKE & CO., Selling Agts., }
Please Mention This Paper.

BOOKS FOR MECHANICS.

FITZGERALD'S BOSTON MACHINIST. 18mo, cloth.	$ 75
CHORDAL'S LETTERS TO MECHANICS, &c. 12mo.	2 00
THURSTON'S MATERIALS OF CONSTRUCTION. 8vo.	5 00
THURSTON'S FRICTION IN MACHINERY. 8vo.	3 00
WEST'S FOUNDRY PRACTICE. 12mo, plates.	2 50
WEST'S MOULDER'S TEXT BOOK. 12mo, plates.	2 50
MCCORD'S PRACTICAL MECHANISM. 8vo	5 00
WRINKLES AND RECIPES FOR MECHANICS AND ENGINEERS	2 00
GRIMSHAW'S ART OF SAW FILING. 18mo, plates.	1 00
HOLLY'S ART OF SAW FILING. 18mo, plates.	75
BALDWIN'S STEAM HEATING FOR BUILDINGS	2 50
CROMWELL'S TOOTHED GEARING, &c. 12mo	2 00
CROMWELL'S BELTS AND PULLEYS. 12mo.	2 00
SINCLAIR'S LOCOMOTIVE ENGINE RUNNING. 12mo	2 00
THURSTON'S STATIONARY STEAM ENGINES. 12mo	1 50
GRIMSHAW'S STEAM ENGINE CATECHISM.	1 00

JOHN WILEY & SONS, 15 Astor Place, N. Y.

CATALOGUES AND CIRCULARS GRATIS.



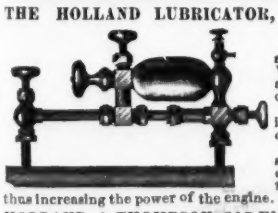
Almond Drill Chuck

Sold at all Machinists' Supply Stores,

T. R. ALMOND,

83 & 85 Washington St., Brooklyn, N. Y.

THE HOLLAND LUBRICATOR, VISIBLE DROP,



Is guaranteed to be:
1. A perfect insurance against the cutting of Valve seats, Cylinder and Governor Valves of the engines.
2. It will pay for itself in six months in saving of oil, coal and packing.
3. It will insure more speed in the revolutions of the engine, say from 1 to 2 strokes per minute, thus increasing the power of the engine. Manufactured by

HOLLAND & THOMPSON, 217 River St., Troy, N.Y.

ROLLER TUBE EXPANDERS,

FORGED STEEL. SHEET METAL PUNCHES. SCREW PUNCHES.

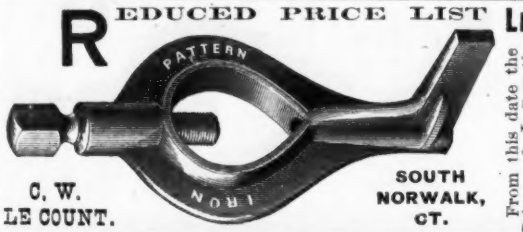
A. L. HENDERER, Wilmington, Del.

ACME MACHINERY COMPANY,

CLEVELAND, OHIO.

Advantages of the "Acme" Bolt Cutter: Large bearing on top of Dies by using a Cap. Fine adjustment by differential screw. Positive Toggle Lock Die-ring connected to Barrel. Positive Motion. Every part exposed to view, it cannot clog with chips or scale. Quickness of changing Dies (in less than a minute). No springs used. Index on Head so a fit can be cut at once. Cheapness of Dies. Advantage of Plain and not the disadvantage of Case Dies. Reversible Dies. Even number of Dies and ahead of center. All wearing parts are tempered Steel, made to Jigs and Standard Gauges, and are interchangeable. Dies cut in one Head will fit any other, and where more than one Head is used this is a very vital point. *The ACME Head can be put on almost any Bolt Cutters, and parties having other make of machines will find a great improvement by putting an "ACME" Head and Dies on it.*

REDUCED PRICE LIST



C. W. LE COUNT. SOUTH NORWALK, CT.

LE COUNT'S LATHE DOGS.

From this date the Prices of LeCount's Lathe Dogs will be as follows:

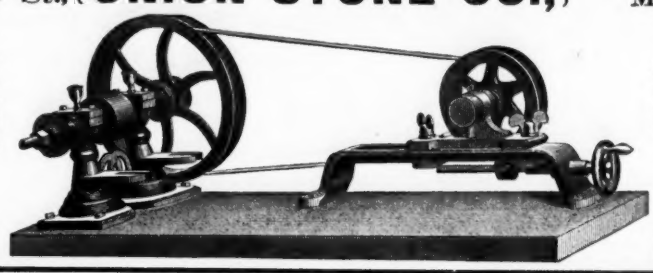
REDUCED PRICES OF LE COUNT'S MALLEABLE IRON LATHE DOG.

No.	INCH.	PRICE.	No.	INCH.	PRICE.
1	3/8	$0.30	8	2	$1.00
2	1/2	.30	Small set of 8,		4.05
3	3/4	.40	9	2 1/2	1.20
4	1	.40	10	3	1.30
5	1 1/4	.60	11	3 1/2	1.40
6	1 1/2	.60	12	4	1.60
7	1 3/4	.90	Full Set of 12,		10.00

38 & 40 Hawley St., **UNION STONE CO.,** BOSTON, MASS.

Endless Polishing Belt Machine for Removing Scale and Polishing Irregular pieces of Work.

Send for Price List.

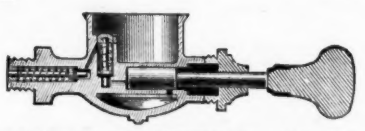


SIZES:
1 1/4 in. wide,
2 " "
3 " "
4 " "

Endless Belts of Any Length and Width to Order.

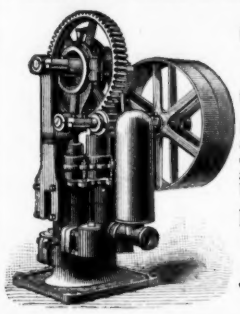
HAND CYLINDER OIL PUMPS.

These oil pumps are constructed on a different principle from any other pumps in the market. There are no suction valves which all other pumps have, and there are two check valves between the oil and steam, a combination which no other oiler has. If one valve gets out of order, the other will do the work. These oilers are particularly adapted to Farm Engines, and engines that are run by men who are not engineers, as they are so simple in construction that any boy can readily understand how to use them. The check valves are made with guide top and bottom, and have seats made of Jenkins' Patent Packing (unless ordered otherwise.) By using this packing which is elastic, the valves are not affected by heat or cold and are always steam tight, unless dirt should get under the valves.



A. ALLER, 109 Liberty St., New York.

THE ECONOMIC PATENT BOILER FEED PUMP



Manufactured by
I. B. DAVIS & SON,
Hartford, Conn.

The only Double-Acting Geared Pump.

It is compact and Systematic in design and Economical in its operation. All its parts are arranged for durability.

BENJ. F. KELLEY, Agent,
91 Liberty St., New York.
Philadelphia Office,
JAMES BERRYMAN,
125 N. Fourth St.

FORBES & CURTIS, Mfrs. of FORBES' PAT. DIE STOCK.

Pipe Cutting and Threading MACHINES, ETC.

BRIDGEPORT, CT.

WHY THIS IS PUT HERE!

For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the

NEW PULSOMETER,

THE CHEAPEST AND BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.

More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.

Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A-1 Testimonials. Mailed Free.

PULSOMETER STEAM PUMP CO., 83 JOHN STREET, N. Y.

Gap Lathe, $125.

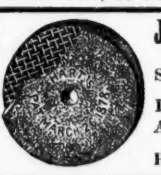
SHEPARD'S NEW $60 SCREW-CUTTING FOOT LATHE.

Foot and Power Lathes, Drill Presses, Scroll-saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc.

Lathes on trial. Lathes on payment.

Send for catalogue of Outfits for Amateurs or Artisans.

Address, H. L. SHEPARD, Agent, 134 E. Second St., Cincinnati, O.



J. WENDELL COLE, M. E.

Manager of Pennsylvania Southern Lake regions and the Northwest for
DETROIT EMERY WHEEL CO.
Address, Box 84, Columbus, O., or P. O. Box 152 Chicago.
Hart's Corundum-Emery Wheels.

Joshua Rose's Great Treatise on Steam Engines.

JUST PUBLISHED.

Modern Steam Engines.

An elementary treatise upon the Steam Engine, written in plain language, for use in the workshop as well as in the drawing-office; giving full explanations of the construction of modern Steam Engines, including diagrams showing their actual operation, together with complete but simple explanations of the operations of various kinds of valves, valve motions, link motions, etc., thereby enabling the ordinary engineer to clearly understand the principles involved in their construction and use, and to plot out their movements upon the drawing-board. By Joshua Rose, M.E., author of "The Complete Practical Machinist." Illustrated by 422 engravings. In one volume quarto, 320 pages. *Price*, $6.00, *free of postage to any address in the world.*

☞ *An illustrated circular, 8 pages, 4to, giving the contents of this remarkable book, will be sent free to any one who will furnish his address.*

OTHER BOOKS BY THE SAME AUTHOR.

The Complete Practical Machinist:—embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, The Making and Use of Tools, Tool Grinding, Marking Out Work, etc. Illustrated by 356 engravings. 14th edition, thoroughly revised and in great part rewritten. 12mo. $2 50.

Mechanical Drawing Self-taught:—comprising Instructions in the Selection and Preparation of Drawing Instruments, Elementary Instruction in Practical Mechanical Drawing, together with Examples in Simple Geometry and Elementary Mechanism, including Screw Threads, Gear Wheels, Mechanical Motions, Engines and Boilers. Illustrated by 330 engravings. 8vo. $4 00.

The Slide Valve Practically Explained:—embracing Simple and Complete Demonstrations of the Operation of each Element in the Slide Valve Movement, and Illustrating the Effects of Variations in their Proportions, by Examples carefully selected from the most recent and successful practice. Illustrated by 35 engravings. 12mo. $1 00.

☞ *The above or any of our books sent by mail, free of postage, at the publication prices, to any address in the world.*

☞ *Our Descriptive Catalogue of Practical and Scientific Books, 96 pages, 8vo, and our other Catalogues and Circulars, the whole covering all of the Branches of Science Applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Phila., Pa., U. S. A.

I. W. COLBURN & Co.

FITCHBURG, MASS.
100 MAIN ST.
LOWEST LIVING PRICES ARC AND INCANDESCENT LIGHTING AND PLATING MACHINES.

J. C. HOADLEY,

CIVIL AND MECHANICAL ENGINEER
and Expert in Patent Causes,
28 STATE STREET, Room 28, BOSTON, MASS.

Buffalo Cupola & Forge Blowers

Warranted superior to any other make.

All sizes and styles of every class of work.

BUFFALO FORGE CO.
Buffalo, N. Y.

Send for Catalogue and prices

WORTHINGTON —HIGH DUTY— Pumping Engine

—FOR—

WATER WORKS

OVER 100,000,000 DUTY

—GUARANTEED—

SEND FOR RECENTLY ISSUED PAMPHLET

HENRY R. WORTHINGTON
NEW YORK CITY.

SAFE ECONOMICAL DURABLE BOILERS

HARRISON SAFETY BOILER WORKS. PHILADELPHIA, PA.

MERITS PROVEN 20 YEARS RECORD

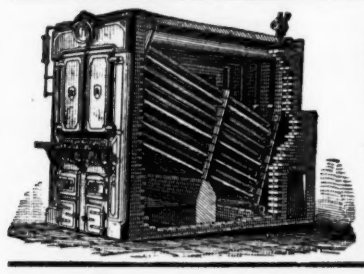
"STEAM" A VALUABLE BOOK for EVERY STEAM USER AND ENGINEER PUBLISHED FOR FREE DISTRIBUTION, BY

THE BABCOCK & WILCOX CO.

Manufacturers of

WATER-TUBE BOILERS,

107 Hope St., GLASGOW. *30 Cortlandt St., NEW YORK.*



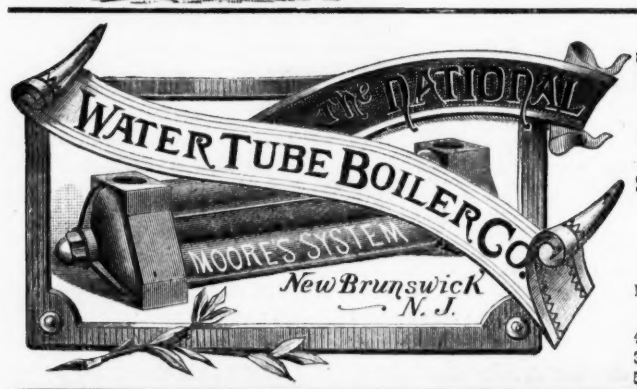
ROOT'S NEW WATER-TUBE STEAM BOILER

SAFE! ECONOMICAL! DURABLE

For ILLUSTRATED CATALOGUE of NEW BOILER, Address

ABENDROTH & ROOT MANUFG. CO.

—28 CLIFF STREET, NEW YORK.—



—OUR—

WATER-TUBE BOILERS

ARE

UNSURPASSED

FOR

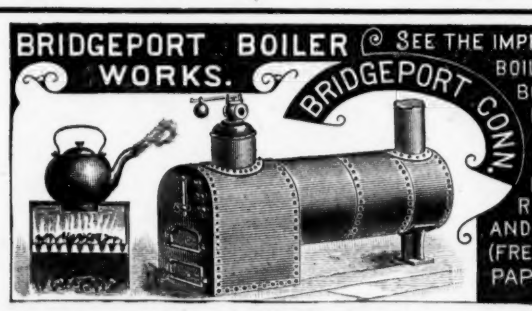
SAFETY, ECONOMY AND DURABILITY.

MAIN OFFICE,

New Brunswick, N. J.

BRANCHES:

49 NORTH 7th St., Philadelphia.
36 CORTLANDT ST., New York.
50 OLIVER ST., - Boston.



SEE THE IMPROVEMENTS IN STEAM BOILERS, BOILER FRONTS, BOILER FURNACES, AND FEED WATER HEATERS MADE AT THESE WORKS BEFORE BUYING STEAM PLANT. SEND FOR HISTORIES OF STEAM BOILERS AND FFED WATER HEATERS (FREE) ON MENTIONING THIS PAPER. WM. LOWE.

BUILDER OF

BOILERS, GAS HOLDERS, GAS GENERATORS,

Henry Warden,

GERMANTOWN JUNC., PHILADELPHIA.

Successor to WARDEN & MITCHELL.

TANKS, STILLS, BRIDGES Etc., Etc.

Hydraulic Riveting Plant and Full Facilities.

We shall be pleased to mail, on application, to all that are interested in our articles a copy of our New Illustrated Catalogue, just issued.

SCHAFFER & BUDENBERG,
40 John Street, New York.

SEBASTIAN, MAY & COMPANY'S Improved Screw Cutting Foot or Power Lathes

Catalogue of Lathes, Drill Presses and Machinists' Tools and Supplies mailed on application. Lathes on Trial.

167 W. Second St., Cincinnati, O.

THOS. H. DALLETT & CO.

13th & Buttonwood Sts., PHILA., PA.

MANUFACTURERS OF

PATENT

Portable Drilling Machines,

VERTICAL DRILLS,
Radial Drills, Multiple Drills,
HAND DRILLS.

Send for Illustrated Catalogue.

A. J. WILKINSON & CO.

Boston, Mass.,

Makers of the most complete assortment of

Micrometer Calipers and Fine Measuring Tools

TO BE FOUND IN THE WORLD.

Send for Illustrated Catalogue with Tables.

Use the JENKINS STANDARD PACKING in the worst joint you have, and if, after following directions, it is not what we claim, WE WILL REFUND THE MONEY.

Our "Trade Mark" is stamped on every sheet. None genuine unless so stamped. ☞ Send for Price List.

JENKINS BROS.,

71 John Street, N. Y. 79 Kilby Street, Boston

13 South Fourth Street, Phila

Oneida Steam Engine & Foundry Co., Oneida, N. Y.

Manufacturers of all kinds of LATHE —AND— DRILL CHUCKS

Under Westcott's Patent.

Capacity Little Giant Improved.			
No. 00.	holds	0 to	1/4 inch.
" 0	"	0 to	3/8 "
" 1	"	0 to	5/8 "
" 2	"	0 to 1	"
" 2½	"	0 to 1	"

SEND FOR CATALOGUE.

STEEL CASTINGS

From 1-4 TO 15,000 lbs. WEIGHT.

True to Pattern, sound, solid, free from blow-holes and of unequaled strength

Stronger and more durable than iron forgings in any position or for any service whatever.

40,000 CRANK SHAFTS and 30,000 GEAR WHEELS of this steel now running prove this

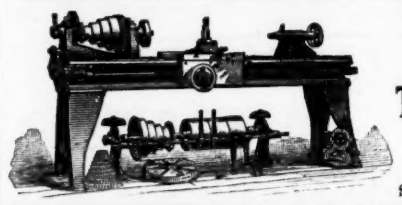
Cross-Heads, Rockers, Piston-Heads, etc., for Locomotives.

STEEL CASTINGS of every description.

Send for Circulars and Prices to

CHESTER STEEL CASTINGS CO.,

Works, Chester, Pa. Office, 407 Library St., Philadelphia, Pa.



NEW AND IMPROVED 16" ENGINE LATHE.

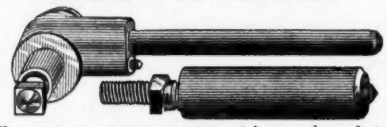
The Muller Machine Tool Company.

179 WEST PEARL ST., CINCINNATI, OHIO.

SEND for CIRCULARS & PRICES.

WHITNEY'S NEW RATCHET.

Steel. Polished.

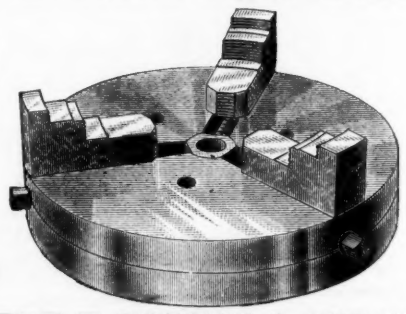


Has greater range than any two ratchets made, and at the price of one. Send for circulars.

VARIETY MACHINE CO., Warsaw, N. Y.

ESTABLISHED 1851.

THE HORTON LATHE CHUCK.



THE E. HORTON & SON CO.

Canal St., Windsor Locks, Conn., U. S. A.

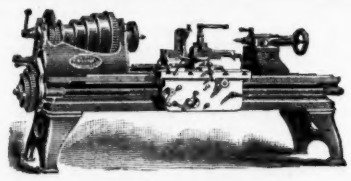
WELDLESS STEEL TUBES

QUICK OPENING GATE VALVE

COLD DRAWN

SMOOTH INSIDE & OUT.

JOHN S. LENG, 4 Fletcher St N.Y.



NEW HAVEN MANFG. CO.

New Haven, Conn.

IRON-WORKING MACHINERY,

Planers, Shapers, Drills, Slotters, Etc.

Ferracute Machine Co.,

BR'DGETON, N. J., U. S. A.

PRESSES, DIES,

and all other Sheet-Metal Tools.

A new line of PUNCHING PRESSES just out.

Send for Catalogue.

PATENT UNIVERSAL SCREW-CUTTING, CENTER, DEPTH, ANGLE AND TWIST DRILL GAUGE.

J. WYKE & CO.

Fine Machinists' Tools, 2, BOSTON, MASS. Send for Circular.

—OUR— NEW CATALOGUE OF TOOLS

and Supplies sent free to any address on receipt of Ten Cents in stamps (for postage).

CHAS. A. STRELINGER & CO., Wood Ave., Detroit, Mich.

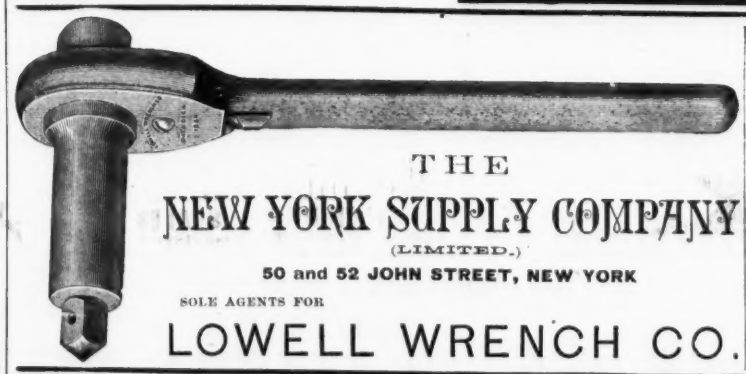
CRANK PLANERS

Superior Design & Workmanship, Extra Heavy (1500 lbs.)

DOWN, ANGULAR AND CROSS-FEED,

TO PLANE 12x16x15.

THE R. A. BELDEN CO., DANBURY, CT.



THE NEW YORK SUPPLY COMPANY

(LIMITED.)

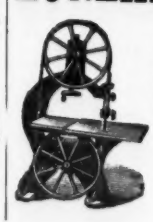
50 and 52 JOHN STREET, NEW YORK

SOLE AGENTS FOR

LOWELL WRENCH CO.

Railway, Machinists, Engineers, Mill and Miners Supplies.

EUREKA BAND SAW.

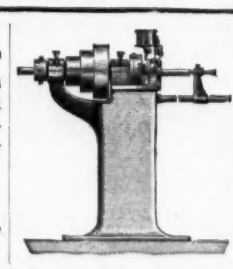


We build three sizes, at prices lower than an equally good Band Saw can be had elsewhere. For further information, inquire of

FRANK & CO.,

176 Terrace Street,

BUFFALO, N. Y.



William Barker & Co.

Manufacturers of

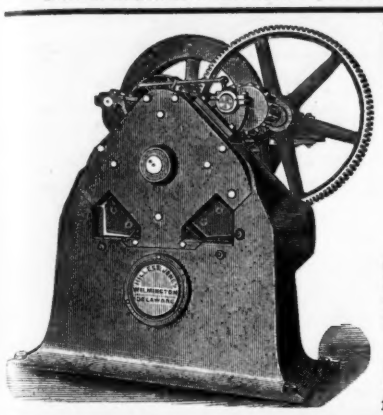
IRON AND BRASS —WORKING— MACHINERY

140 & 142 E. Sixth Street, N'r Culvert, Cincinnati, O.

Send for circulars and prices.

MORSE TWIST DRILL AND MACHINE COMPANY, New Bedford, Mass.
Manufacturers of **Morse Patent Straight-Lip Increase Twist Drills.**

SOLID AND SHELL REAMERS, BEACH'S PATENT SELF-CENTERING CHUCK, BIT STOCK DRILLS, DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.



Double Angle Iron Shear
BUILT BY
HILLES & JONES,
WILMINGTON, DEL.

We claim many advantages in this tool over any other style made: Being double, it will cut either right or left; Its knives are of a proper height for convenience of working; It will cut a bar square off or on a bevel; Being supplied with a clutch, it can be stopped instantly.
It is a serviceable tool for bridge building, ship building, or any kind of railroad work. It is *the* machine for shop work, as the knives can be changed to cut round, flat and square iron. THREE SIZES.

Grinds Drills ¼ to 1⅝ in. inclusive.

ANY ONE CAN USE IT.

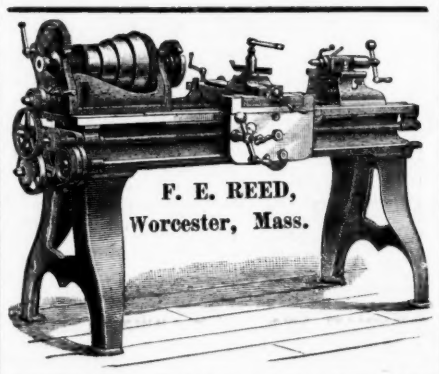
THE HOUGH TWIST DRILL — GRINDER —
The SPECIAL CLAIMS made for this Tool are its
Simplicity, Ease of Operation, Low Price.
—MANUFACTURED BY—
Warner & Hough Machine Co.
ST. PAUL, MINN.

Manning, Maxwell & Moore, 111 Liberty St., New York. | Tallman & McFadden, 1025 Market St., Phila.

DROP FORGINGS OF IRON OR STEEL
BEECHER & PECK, NEW HAVEN CONN.
PECK'S PAT. DROP PRESS. NEW HAVEN
BEECHER & PECK. CONN.

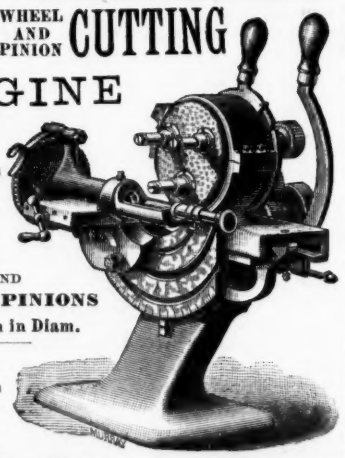
MACHINERY
For Reducing and Pointing Wire.
Especially adapted to pointing wire rods and wire for drawing.
For Machines or information, address the manufacturer.
S. W. GOODYEAR, Waterbury, Ct.

S. ASHTON HAND MFG. CO.,
Toughkenamon, Chester Co., Pa.
MAKERS OF FIRST-CLASS
ENGINE LATHES
Are now in position to put on the market
14" **ENGINE LATHES OF NEW DESIGN,**
guaranteed to be equal in material, design and workmanship to the best ever offered.



F. E. REED,
Worcester, Mass.
ENGINE Lathes, Hand Lathes, Foot Lathes, Upright Drills and Milling Machines. Agents, Manning, Maxwell & Moore, 111 Liberty Street, New York.

No. 5 WHEEL AND PINION CUTTING ENGINE
Will Cut Brass Wheels to 5 Inches in Diameter, Spur, Bevel or Crown;
AND
STEEL PINIONS
To 1 Inch in Diam.
Send for Description and Prices.

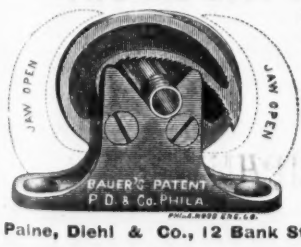


SLOAN, CHACE & COMPANY
, 289-293 Washington St., Newark, N.J.
BUILDERS OF WATCH AND CLOCK MACHINERY.

L. S. STARRETT,
Manufacturer of
FINE TOOLS
ATHOL, MASS.
SEND FOR FULL LIST

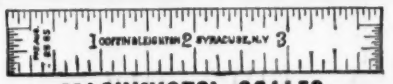
IF YOU ONLY KNEW HOW GOOD THE
ELLIOTT CUTTING OFF TOOL
IS,
You would not sleep until you had ordered one.
STERLING ELLIOTT, NEWTON, MASS.

BAUER'S PATENT
Instantaneous, Self-Adjusting and Self-Gripping
PIPE AND BOLT VISE.



No "kit" complete without a No. 1.
The new geared Jaws are in great favor.
No. 1 holds ⅛" to 1⅛" tubes.
Price $3.00; weight 3 lbs.
Get list.
Paine, Diehl & Co., 12 Bank St., Phila., Pa.

PATENTS E. B. STOCKING, ATTY.
Opp. Pat. Of. Washington, D.C.
Send sketch for free report as to patentability and new book on Patents.

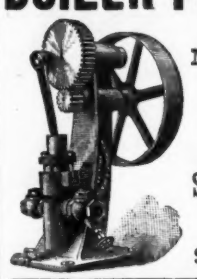


MACHINISTS' SCALES,
Patent End Graduation.
We invite comparison for accuracy with all others.
Every Scale Guaranteed. Send for List.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

THE EATON, COLE & BURNHAM CO.
82 & 84 FULTON STREET, NEW YORK.
Factory: BRIDGEPORT, Conn.
MANUFACTURERS OF
Pipe Cutting and Threading Machines
OPERATED BY HAND OR POWER.
FITTINGS, VALVES, PIPE, PIPE TOOLS.

ADJUSTABLE DIE STOCK.
Cuts pipe ¼" to 2". Also made in *Ratchet* form, and with cutting-off attachment.
ALL STYLES OF Iron & Brass Goods FOR Steam, Water and Gas.

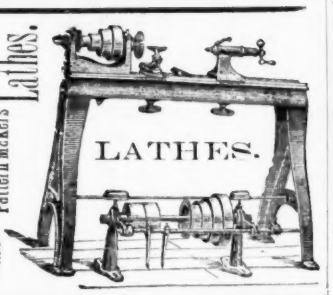
BOILER FEED PUMP
MADE BY
M. R. MUCKLE, Jr. & CO.
PHILADELPHIA,
SIZES TO SUIT STEAM PLANTS, UP TO 300 H. P.
Send For CirculaR



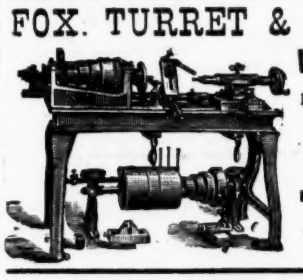
SHAPING MACHINES
For Hand and Power, 6", 8" and 10" Stroke.
Adapted to all Classes of Work to their capacity.
CIRCULARS FURNISHED.
BOYNTON & PLUMMER, Worcester, Mass.

P. BLAISDELL & CO.
Manufacturers of
Machinists' Tools.
WORCESTER, MASS.

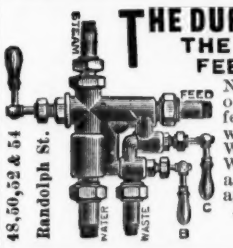
GEO. L. FAIRBANKS, WORCESTER, MASS. MANUF'R OF HAND LATHES, WOOD TURNING —AND— Pattern Makers' Lathes.



FOX. TURRET & SPEED LATHES AND BRASS FINISHERS' TOOLS,
CAGE MACHINE WORKS,
WATERFORD, NEW YORK.



THE DUPLEX INJECTOR
THE BEST BOILER FEEDER KNOWN.



48, 50, 52 & 54 Randolph St.
Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler. Will start when it is hot. Will feed water through a heater. Manufactured and for sale by
JAMES JENKS & CO. Detroit, Mich.

BEVEL GEARS,
Cut Theoretically Correct.
For particulars and estimates apply to
BREHMER BROS.
Machinists,
440 N. 12th St., Philadelphia, Pa.

D. SAUNDERS' SONS
MANUFACTURERS OF THE ORIGINAL
TRADE **I. X. L.** MARK.
Pipe Cutting and Threading Machine.
BEWARE OF IMITATIONS.
None genuine without our Trade-mark and Name.
STEAM AND GAS-FITTERS' HAND TOOLS.
Pipe Cutting and Threading Machines, for Pipe Mill Use, a Specialty.
Send for Circulars. YONKERS, N. Y.

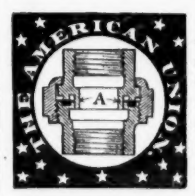
Iron and Steel
DROP FORGING
Of Every Description, at Reasonable Prices.
THE R. A. BELDEN CO., DANBURY, CT.

UNIVERSAL RADIAL AND RADIAL DRILLING MACHINES
THREE DESIGNS. SIX SIZES.
EMBODY ALL DESIRABLE FEATURES
PRICES $450.00 & UPWARD
ADDRESS UNIVERSAL RADIAL DRILL CO
CINCINNATI O. U.S.A.

WHITE'S FLEXIBLE METALLIC FILLET
For use of Pattern Makers. Sizes 1 4 to 1 in.
HOWARD WHITE, 44 N. 4th ST., PHILA PA.

Send for Circular & Samples.

It will "Pay the Piper,"

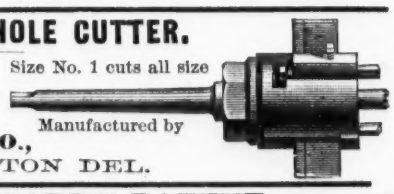


If he aims to pipe well for STEAM, WATER, GAS, ACIDS, OILS, AMMONIA, &c., to examine this UNION, which requires no packing, but is always ready for instant use. When you next order Fittings of any Dealer, ask for a sample American Union to come with them, and it will tell you the whole story, or we will, if you write us for particulars.
PANCOAST & MAULE,
PHILADELPHIA, PA.
If you happen to take an Interest in doing First-class work about your establishment, send for a Circular of this Union.

W. C. YOUNG & CO., Worcester, Mass. Manufacturers of
Engine Lathes, Hand Lathes,
FOOT POWER LATHES, SLIDE RESTS, Etc.

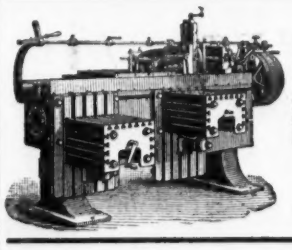
CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK

HARRISON'S ADJUSTABLE FLUE-HOLE CUTTER.
An effective labor-saving tool for the boiler shop. holes from 2 to 5 inches inclusive. The cutters proper are forged from ⅝-inch round steel, can be renewed at trifling cost; are easily adjusted and firmly held.
Size No. 1 cuts all size



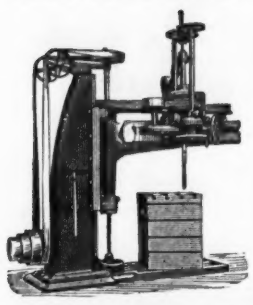
Manufactured by
REMINGTON & CO.,
WILMINGTON DEL.

RICHARDS' PATENT
Combination Planer and Shaper.



Several sizes, any length of bed. Only the head travels, the work remaining stationary. Combines advantages of both planer and shaper. Effective, durable and convenient. A number in use, giving perfect satisfaction. Send for circular. Manufactured by
E. A. WALKER,
75 Laurel Street, Philadelphia.

The United States Mitis Company,
26 BROADWAY, NEW YORK.
is prepared to issue licenses for the use of patents covering processes for the production of "Mitis Castings" in wrought iron and steel, and furnaces for melting and heating.
"Mitis" Castings retain in every respect all the valuable qualities of the wrought iron and steel (scrap) from which they are made. Do not require annealing. Can be welded and worked under the hammer as well as the raw material.
W. F. DURFEE, General Manager.



WILLIAM SELLERS & CO.,

ENGINEERS AND MANUFACTURERS OF

IMPROVED MACHINE TOOLS FOR WORKING IRON AND STEEL

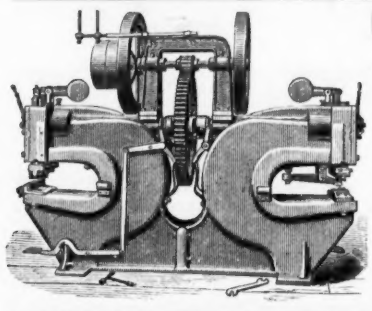
STEAM HAMMERS, PUNCHES and SHEARS, BENDING ROLLS, DRILL AND TOOL GRINDERS, Etc., Etc. LATHES, PLANERS, BORING and TURNING MILLS,

SHAFTING, PULLEYS, HANGERS, COUPLINGS, Etc.

|| IMPROVED INJECTORS FOR FEEDING BOILERS. ||

PAMPHLETS, PHOTOTYPES AND PRICES FURNISHED ON APPLICATION TO

OFFICE AND WORKS, PHILADELPHIA, PENNA.



THE LONG & ALLSTATTER CO. Hamilton, OHIO.

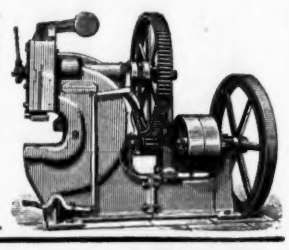
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven

Punches and Shears.

Over 300 Sizes.

ALSO,

Power Cushioned Hammer.



Send for new Catalogue.

Suckow's Patent Extension Jack

The best wrecking screw jack made, because of ready adjustment to unusual positions. The load can be in almost any position, allowing the screw to work freely without the use of packing strips or wedges to give equal bearings. A complete carrying or straight jack. Circulars and prices on application.

PEDRICK & AYER, Philadelphia, Pa.

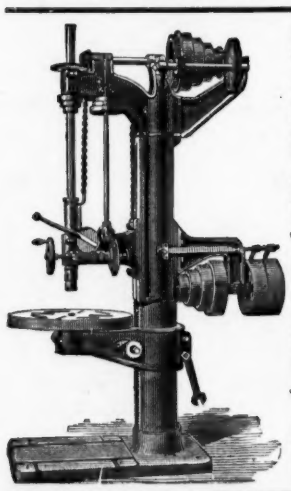
IS A NATURAL PRODUCT TAKEN FROM OUR OWN MINES.

Unlike any of the artificial compounds or manufactured products heretofore on the market. We

FLUOR SPAR Send for Circular, Prices **THE BEST** and Experience of Users. **FOUNDRY FLUX**

guarantee its success, if directions are followed, or *ask no pay.* Only 8 or 10 lbs. to the ton of iron required to purify the iron, and will more than pay for itself in keeping the cupola clean.

THE EVANSVILLE LEAD & SPAR MINING CO., Successors to B. Burbank & Co., Evansville, Ind.

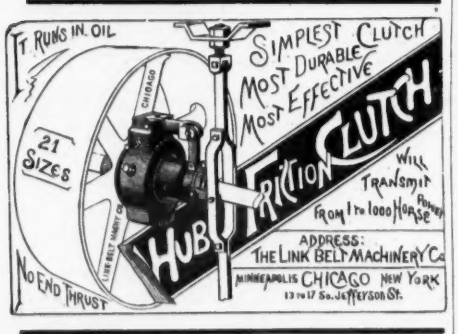


UPRIGHT DRILLS

A SPECIALTY.

ALL SIZES WITH PATENT QUICK RETURN FEED AND ALL MODERN IMPROVEMENTS.

H. BICKFORD, Cincinnati, Ohio.



HODGE'S

Universal Angle Union

PATENTED.

Combining an elbow and union, and can be set at any angle at which it is desired to run the pipe.

Manufacturers & Wholesale Agents,

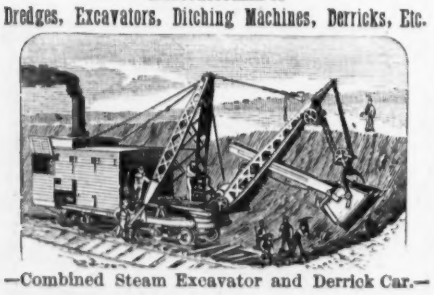
ROLLSTONE MACHINE CO., 45 Water St., FITCHBURG, MASS.

OSGOOD DREDGE CO., ALBANY, N. Y.

RALPH R. OSGOOD, Pres. JAMES H. BLESSING, Vice-Pres. JOHN K. HOWE, Secretary and Treasurer.

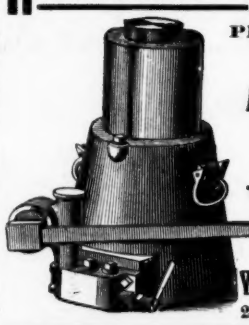
MANUFACTURERS OF

Dredges, Excavators, Ditching Machines, Derricks, Etc.



—Combined Steam Excavator and Derrick Car.—

HYDROSTATIC MACHINERY



PRESSES, PUMPS, PUNCHES, ACCUMULATORS, JACKS, VALVES, FITTINGS, Vault Elevators, &c.&c.

Watson & Stillman,
204-210 E. 43d St., N.Y.

FAY & SCOTT, DEXTER ME.

MANUFACTURERS OF

WOOD LATHES,

Drill Lathes, Shaping Machines, Milling Machines, Planer Centers, Etc.

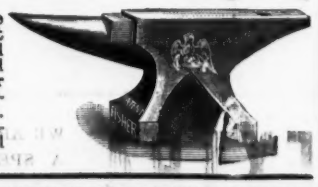
SEND FOR CATALOGUE.

EAGLE ANVIL WORKS,

Trenton, N. J.

The **Fisher Double Screw Leg Vise.**—Warranted stronger grip than any other Vise. Always parallel and cannot be broken.

Send for Circulars.



The **Eagle Anvil.**—Best Cast Steel Face & Steel Horn. Better than any English anvil. Fully warranted and lower price.

THE GARDNER GOVERNOR

Over 40,000 in Use.

ADAPTED TO EVERY STYLE OF STATIONARY AND PORTABLE STEAM ENGINE.

Warranted to give satisfaction or no sale.

FOR CIRCULARS AND PRICES ADDRESS,

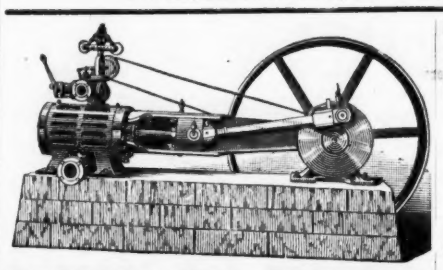
The Gardner Governor Co.
QUINCY, ILL.

Southwark Foundry & Machine Co.

ENGINEERS AND MACHINISTS.

WASHINGTON AVE. AND FIFTH ST., PHILADELPHIA, PA.

PORTER-ALLEN and SOUTHWARK ENGINES, BOILERS AND TANKS, BLOWING ENGINES, PUMPS, GAS APPARATUS, BESSEMER CONVERTERS, ETC., SUGAR MACHINERY, HYDRAULIC MACHINERY, ETC., ETC.



STEARNS MFG. COMPANY,

ERIE, PA.

Engines from 15 to 400 Horse Power.

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogues.

SAW MILLS and GENERAL MACHINERY.

Works at ERIE, PA.

HOISTING ENGINES.

Of any power and Style. SINGLE AND DOUBLE CYLINDER, with improved patent friction drums, especially adapted for bridge building, dock building, pile driving, coal hoisting, quarries, mines, etc.

J. S. MUNDY,
Newark, N. J.

This patent has been sustained in U. S. Courts in New York and N. J.

THE NATIONAL FEED WATER

HEATER.

A brass coil heater supplying feed water at 210° to 212° Fahrenheit by use of exhaust steam Our prices are low and reasonable, and we aim to supply the *cheapest, best and most effective Heater in the market.* Sixteen sizes. 10 H.P., $20; 100 H.P., $150; 500 H.P., $600. Iron, Brass and Copper Coils and Bends made to order. Circulars and price lists sent on application.

National Pipe Bending Co.
NEW HAVEN, Conn.

THE

Slate Sensitive Drill

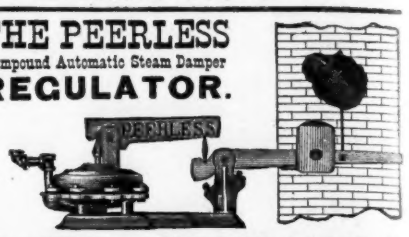
Adapted to rapid work with small drills. Its extreme sensitiveness prevents clogging and breakage of drills. Has a switching table with attachment for center drilling. Instantly adjustable to different lengths of work. Over 200 already in use. Send for circular.

DWIGHT SLATE,
Hartford, Conn.

THE PEERLESS

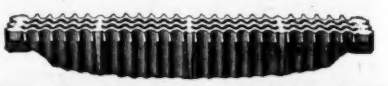
Compound Automatic Steam Damper

REGULATOR.



GUARANTEED THE BEST SAVER OF FUEL IN THE MARKET.

Has been used six years by 700 of the largest mills and firms in the U. S.; not one given out. Always put up by our own mechanics. Warranted to keep in order 5 years. Send for printed testimonial of large users.



THE PEERLESS GRATE BAR.

Warranted not to Warp, and the Most Durable in Use.

American Steam Appliance Co.

W. A. SIMMONS & CO., Sole Agents,
280 Broadway, New York, 22 & 24 N. 4th St., Phila.
MORSE ENGINEERING CO.
1306 Union Avenue, Kansas City, Missouri.
GENERAL AGTS. FOR THE SOUTH WEST.

DIXON'S

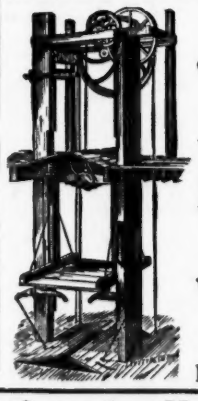
SILICA GRAPHITE PAINT

Beats the World, as a paint for Sheet Iron or Iron Work Exposed to the Weather.

MANUFACTURED BY

Joseph Dixon Crucible Co.
JERSEY CITY, N. J.

MORSE ELEVATOR WORKS.



Morse, Williams & Co.,
(Successors to Clem & Morse)
Builders of all Kinds of
PASSENGER & FREIGHT

Elevators

Office, 411 Cherry St.

Works, Frankford Ave., Wildey and Shackamaxon Sts.,

PHILADELPHIA

New York Office, 108 Liberty St.

Patent Flexible Back Hack Saw for Machinists' Use.

Made of best Band Steel. The teeth only are hardened by an entirely new process, the back remaining soft and flexible. Warranted not to break. Send for sample and circular. Endorsed by the Pratt & Whitney Co., John Henney, Jr., Supt. Motive Power, N. Y. & H. R. R. and others.

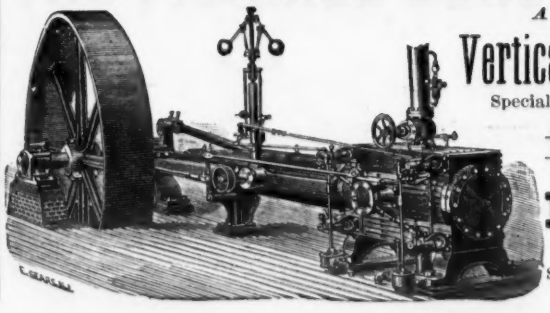
HENRY C. THOMPSON & SONS,
New Haven, Conn. | 51 Leonard St., N.Y.

FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS.

JAS. HUNTER & SON,
North Adams, Mass.

THE FISHKILL CORLISS ENGINE.

A FULL LINE OF SIZES.



Vertical Condensing Engines

Specially adapted for and extensively used in large grain elevators.

BOILERS.

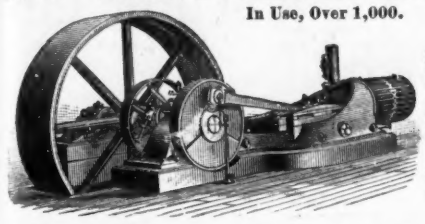
Manufactured by the

Fishkill Landing Machine Co.
FISHKILL-ON-THE-HUDSON, N. Y.

Send for Catalogue **A**, containing Illustrated Descriptions and References

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 1,000. 25 to 1,000 H. P.

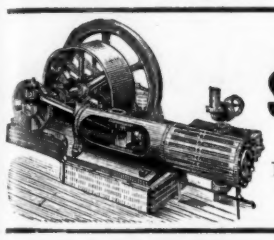


These Engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines, 12 to 100 H P. for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

SALES AGENTS: W. L. SIMPSON, 70 Astor House, N. Y. { N W. ROBINSON, cor. Clinton & Jackson Sts., Chicago, Ill. ROBINSON & CARY, St. Paul, Minn. PRAY MFG. CO., Minneapolis, Minn.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA,

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.



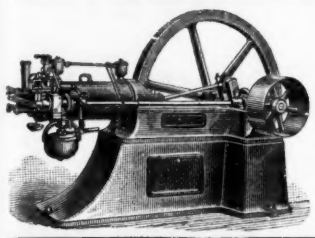
THE BECKETT & McDOWELL MFG. CO.,

STEAM ENGINES, HOISTS, PUMPS,

AND GENERAL MINING MACHINERY.

120 LIBERTY ST., NEW YORK.

☞ SEND FOR ILLUSTRATED CATALOGUE.



"OTTO" GAS ENGINE WORKS,

SCHLEICHER, SCHUMM & CO.,

33d and Walnut Sts. PHILADELPHIA. Branch Office, 130 Washington St. CHICAGO.

OVER 18,000 ENGINES IN USE.

GUARANTEED To Consume 25 to 75 Per Cent. Less Gas than ANY Other Gas Engine per Brake-horse-power.

HEWES & PHILLIPS Iron Works.

IMPROVED

Corliss Engine,

High Pressure,

—Condensing—

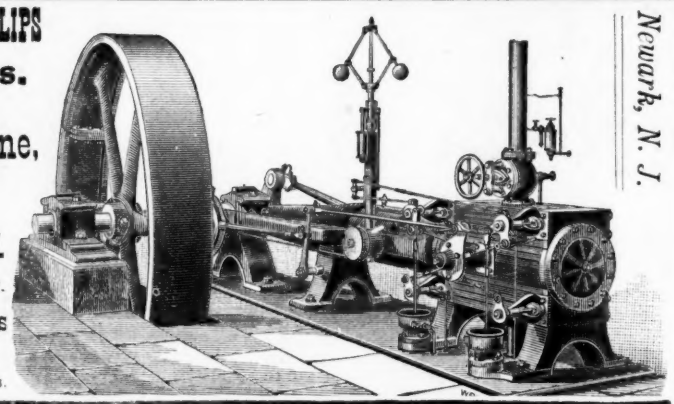
And Compound

Send for Circular.

Kendall & Roberts

CAMBRIDGEPORT, MASS.

EASTERN AGENTS.



Newark, N. J.

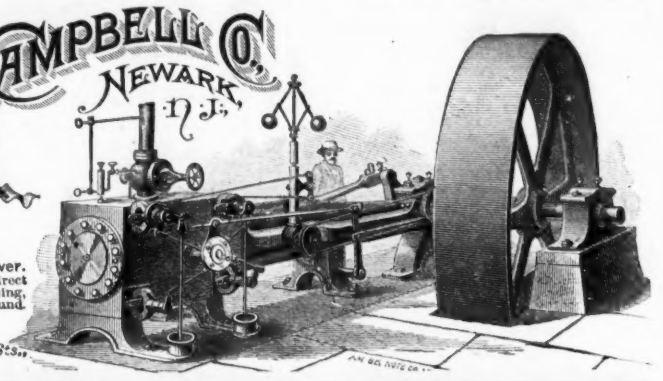
The Watts, Campbell Co.

NEWARK, N. J.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

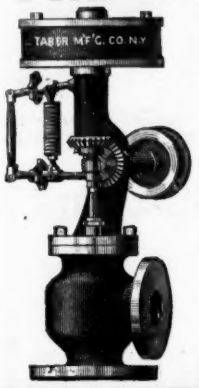
Sizes varying from 30 to 2000 Horse Power. Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound. Send for Circular.

BRANCH OFFICE: *Cor. 5th and Chestnut Sts.,* PHILADELPHIA, PA.



THE TABOR MF'G. COMPANY.

SOLE MANUFACTURERS OF



TABOR STEAM-ENGINE GOVERNOR

Patented April, 1883, and December, 1884.

WILL REGULATE AS CLOSELY AS THE BEST AUTOMATIC CUT-OFF ENGINE.

Perfectly adapted to every type of Stationary and Portable Engine. Fitted with speed adjuster, Sawyer's Lever and Automatic Safety Stop.

SIMPLE, SENSITIVE & DURABLE.

All Parts Interchangeable.

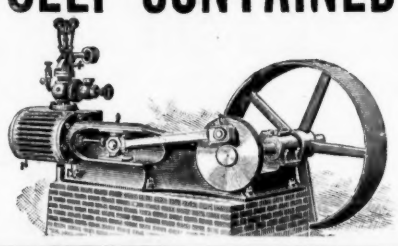
Send for Special Circulars and Price Lists.

OFFICE AND SALESROOM,

113 LIBERTY STREET, - - - NEW YORK CITY.

SELF-CONTAINED STEAM ENGINES.

Stationary or Semi-Portable.



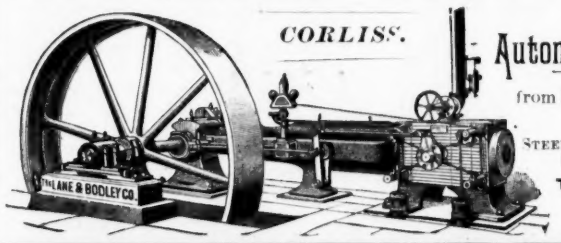
High Standard Maintained. Prices greatly Reduced. Write for New Illustrated Catalogue No. 22

CHANDLER & TAYLOR, Indianapolis, Ind.

ENGINES, SAW MILLS, AND DRAIN TILE

MACHINERY A SPECIALTY.

The Lane & Bodley Co.



CORLISS.

MANUFACTURERS OF

Automatic Cut Off Engines,

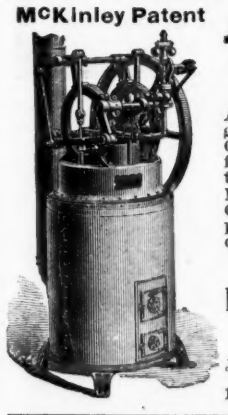
from heavy patterns and of unequalled workmanship.

STEEL BOILERS, FEED WATER HEATERS, SHAFTING, PULLEYS & GEARING.

THE LANE & BODLEY CO.

East side John, cor. Water, Cincinnati, O.

McKinley Patent



AIR ENGINE

The Best and Cheapest on the Market.

No Steam. No water. Absolute Safety. No Engineer. No pumps. No Gauges. No liability to freeze up. No Regulation required

NO EXTRA INSURANCE.

Can be used for any purpose where power is required.

Cheap Fuel. Cheap First Cost.

McKinley Engine Co.

17 Broadway, Cincinnati, O.

JAS H. LANCASTER, GENL. EASTERN AGT.

187 Broadway, New York.

DRAWING INSTRUMENTS

Send for 72-Page ILLUSTRATED CATALOGUE.

WM. T. COMSTOCK, 6 Astor Place, - New York.

VOLNEY W. MASON & CO.,

Friction Pulleys, Clutches and Elevators,

PROVIDENCE, R. I.

STEAM PUMPS

MADE FOR VALLEY ANY SERVICE

VALLEY MACHINE CO. EASTHAMPTON, MASS.

THE ALBANY STEAM TRAP CO.'S

BUCKET AND GRAVITATING

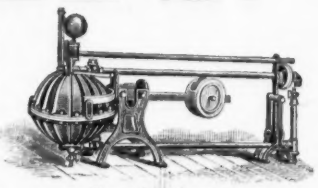
TRAPS.

Bucket.

Automatically drain the water of condensation from **HEATING COILS** and return it to the boilers whether the coils are **above** or **below** the water level in boiler, doing away with pumps and other mechanical devices for such purposes.

We also manufacture **Blessing's Patent Renewable Seat Stop and Check Valves.**—Send for Circular.

Albany Steam Trap Co. Albany, N. Y.



Gravitating.

Planer Vises, 9 Sizes.

SPECIAL MACHINERY DESIGNED AND BUILT.

The Gilkerson Machine Works,

Write us. HOMER, N. Y.

MACHINERY,

NEW AND SECOND-HAND.

12 in. S., 5 ft. Bed Engine Lathe, New
14 " 5 and 7 ft. Bed Engine Lathe, Bogert new
14 " 5½ ft. " " " Harris, cheap
16 " 6 ft. " " " Ames.
15 " 6 ft. " " " Pratt & Whitney.
17 " 6 ft. " " " Putnam, not screw cutting
17 " 6', 7' " " Hewes & Phillips.
18 " 8 ft. " " " Fitchburg, g. o.
19 " 10, 12, 14 " " " Pond, nearly new.
20 " 10 ft. " " " Blaisdell, A1.
21 " 14 ft. " " " Ames, nearly new.
24 " 20 ft. " " " Ames, new.
34 " 12 ft. " " " Harrisburg, good.
16x6 ft. Turret lathe with chasing bar
14 in., 20 in. and 33 in. Turret Head Chucking or Screw Machines, Bridgeport.
23 in., 25 in. and 28 in. Drills, Blaisdell, new.
20 in. Drill, Prentice.
32 " " Pond. Slate's Sensitive Drill.
Elliott Drill. Gang Drill.

SHAPERS.

6 in. Gould. 12 in Sellers.
15 & 24 in. Wolcott.
24 in. Hendey, 24 in. Bridgeport.

PLANERS.

16x42 in. Bridgeport. 18 in x 3 ft., Wheeler,
20 in. x 4 ft., New Haven.
24 in x 6 ft., Powell. 24 in x 8 ft., Ames.
26 in. x 6&8 ft., " 26 in. x 6 ft., Putnam.
32 in x 10 ft., Pond 34 in. x 10 ft., P. & W.
No. 3 Press, Double Crank, Bliss, nearly new.
36 in. Squaring Shear, power, nearly new.
No. 3½ and 4 Press, Stiles.
No. 6 Punch Press, 20 in. Wilder.
25-40 lb Bradley Cushioned Hammer.
Lot of miscellaneous Machinery If you do not see what you want, write and state what is required.

E. P. BULLARD, 14 Dey St., New York.

— MACHINERY, —

NEW and SECOND-HAND.

LATHES.

One.. 17 in. x 6 ft. Forsaith Engine Lathe, 2nd-hand
One.. 18 in x 12 ft. " " "
One.. 16 in. x 6 ft., Fifield, " "
One.. 20 in. x 8 ft. " " "
One.. 21 in. x 8 ft., " " "
One.. 30 in. x 22 ft. New Haven, " "
One.. Cabinet Turret Lathe, Am. Tool Co., "
One.. 20 in. x 10ft., Putnam Engine Lathe, "
Five No. 3 Plain L. D. & Co., Hand " New
Four 18 in. x 8 ft., L. D. & Co. Engine " "
One.. 26 in. x 16 ft., " " " " "
One.. 24 in. x 14 ft. L. D. & Co. " " "
One.. 24 in. x 12 ft. L. D. & Co. " " 2nd-hand
Two 19 in. x 8 ft. " " " " "
Five 13 in. x 5 ft. " " Turret " New
Three No. 1 " " Hand, Fox " "
Four 14 in. L. D. & Co. Fox Monitors " "
One.. 12 in. " " " " "
Five 16 in. " " " " "
One.. 18 in. x 10 ft. L. B. & Co. Engine " 2nd-hand
One.. 19 in. x 6 ft. " " " " "
One.. 19 in. x 10 ft. " " " " "
One.. 20 in. x 12 ft. " " " " "
One.. 26 in. x 12 ft. " " " " "

PLANERS.

One.. 30 in. x 30 in. x 8 ft. Whitcomb Planer, 2nd-hand
One.. 30 in. x 30 in. x 10 ft. " "
One.. 30 in. x 30 in. x 8ft. Pond " "
One.. 36 in. x 36x 10 ft., Enterprise " "
One.. 24 in. x 24x 6 ft Wood & Light " "
One.. 24 in. x 24 in. x 6 ft. L. D. & Co. " New
One.. Belden Crank Planer, "

DRILLS.

One.. 24 in. Bickford Drill, New
One.. 24 in. Bickford Drill, 2nd-hand
One.. 20 in. L. D. & Co. Lever Drill, "
One.. 20 in. L. D & Co. " " New
One.. 28 in. Bickford B. G. & S. F. Drill "
One.. 32 in. " " " " "

MISCELLANEOUS.

Two 20 in. L. D. & Co. Shapers, New
One.. 26 in. " " " "
One.. 32 in. " " " "
Two 34 in. x 4½ in. Grindstones and Frames, "
Two Grant & Bougert Universal Millers, "
One.. Small Valve Miller. "
One.. Sellers Car Wheel Borer, 2nd-hand
One.. 14 in. Steptoe Shaper, "
One.. Water Emery Wheel Grinder, New
One.. Bolt Cutter and Dies to cut up to 1¼ in. "

☞ (See Advertisement on page 16.)

LODGE, DAVIS & CO.

Manufacturers and Dealers,

CINCINNATI, OHIO.

EXTRA HEAVY LATHE

WE ARE MAKING A SPECIALTY OF A 24-INCH LATHE, WITH BED ANY LENGTH DESIRED. THIS LATHE IS DESIGNED FOR SEVERE SERVICE; IT IS THE HEAVIEST OF ITS SIZE EVER PRODUCED, AND THE WORKMANSHIP AS GOOD AS SKILL CAN MAKE IT.

SEND FOR CIRCULAR.

S. S. HEPWORTH & CO., "Glenwood Station," Yonkers, N. Y.

FRICTION CLUTCH PULLEYS,

HOISTING ENGINES, ELEVATORS, STEAM AND BELT POWER.

D. FRISBIE & CO., 112 Liberty St., N. Y.

SEND FOR SPECIAL LIST.

New and Second-hand Machinery.

COLD-ROLLED SHAFTING, HANGERS, PULLEYS, ETC., ETC.

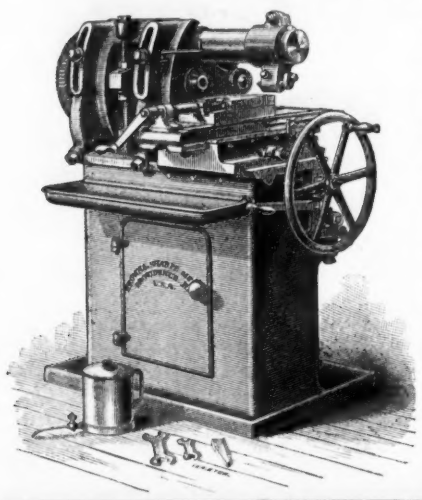
GEORGE PLACE MACHINERY CO.

121 Chambers St., New York.

BROWN & SHARPE MFG. CO.,

Manufacturers of MACHINERY & TOOLS, PROVIDENCE, R. I.

Description of No. 3 Plain Milling Machine.



We have in our works and in constant use, about one hundred Milling Machines, and our experience with them has demonstrated that for manufacturing purposes where many duplicate pieces are required, that the best work is produced and the most economical results obtained from machines that are compact and solid, so arranged that the pieces operated upon can be quickly placed in position and quickly removed after the cut is taken.

We have designed a line of Milling Machines for manufacturing purposes, combining the above desirable qualities, of which the No. 3 Plain Milling Machine is a type, and by their use we have found it practicable to produce from 10 to 20 per cent. more work in a given time than we could possibly obtain from any other type of a milling machine on the same work.

The Spindle is driven by a gear and pinion from a three-step cone with 3″ belt. It has a vertical adjustment of 6″.

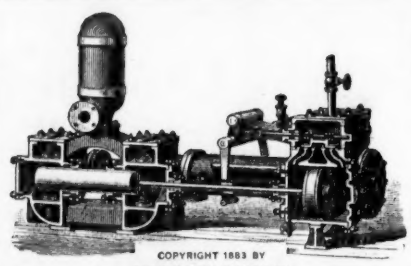
The Table is 9″ wide, 27″ long, and has 12″ longitudinal and 4½″ transverse movement, and is moved longitudinally 2″ by one turn of the hand-wheel.

The Feed is automatic with three changes, stopping automatically at any required point.

The Vise has jaws 6½″ long, 1 7-16″ deep, and will open 3⅝″.

Counter-shaft has pulleys 10″ diam. for 3″ belt, and should run about 375 turns per minute.

The Price includes vise, counter-shaft, wrenches, &c., delivered f. o. b. at Providence, R. I. Weight, 2550 lbs.



COPYRIGHT 1883 BY THE GORDON & MAXWELL CO.

Duplex Steam Pumps

—AND—

WATER WORKS MACHINERY.

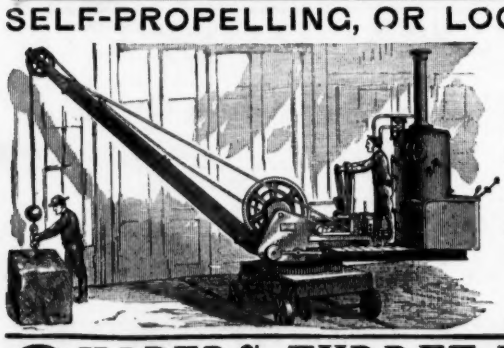
THE GORDON & MAXWELL CO.

HAMILTON, OHIO.

BRANCH HOUSES:

NEW YORK, 96 Liberty Street.
PHILADELPHIA, 713 Chestnut Street.
CHICAGO, 96 Lake Street.

SELF-PROPELLING, OR LOCOMOTIVE CRANES.



HOIST, ROTATE AND TRAVEL UNDER THEIR OWN STEAM.

The most generally useful Crane for shops, contractors, steel mills, etc. All capacities, 2 and 5-ton sizes usually in stock. Send for particulars and illustrated catalogue of all types of cranes.

The Yale & Towne Mfg. Co.,

STAMFORD, CONN.

New York, Chicago, Philadelphia, Boston.

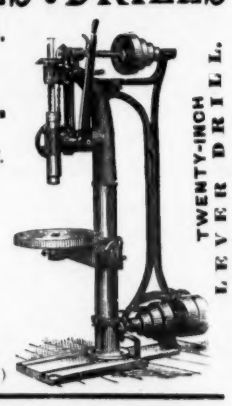
SHAPERS, TURRET LATHES AND DRILLS

20 in.
24 "
28 "
32 "
UPRIGHT DRILLS,
28 in. Back-geared and 32 " Power-feed
DRILLS.

LODGE, DAVIS & CO.

CINCINNATI, OHIO.

Send for Prices, IT WILL PAY YOU.



TWENTY-INCH LEVER DRILL.

(See our advertisement on page 15.)

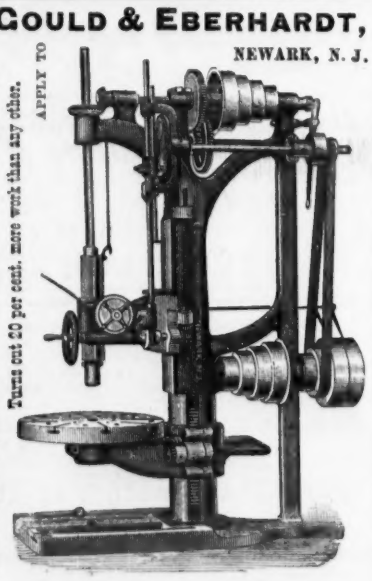
E. COULD & EBERHARDT,

NEWARK, N. J.

EBERHARDT'S NEW DRILL

Turns out 20 per cent. more work than any other.

APPLY TO



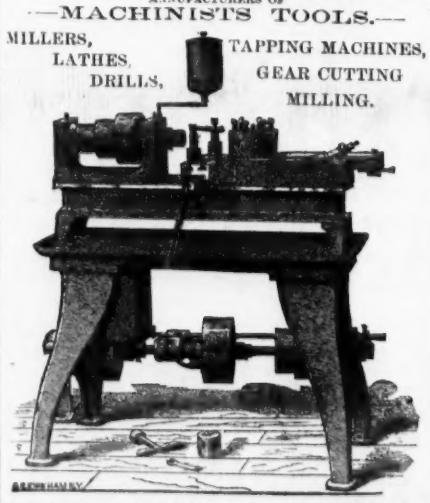
E. E. GARVIN & CO.

No. 139, 141, 143 CENTRE STREET, NEW YORK.

MANUFACTURERS OF

—MACHINISTS TOOLS.—

MILLERS, LATHES, DRILLS, TAPPING MACHINES, GEAR CUTTING MILLING.



Screw Machines—With or Without Wire Feed.

HARTFORD, THE PRATT & WHITNEY CO., CONNECTICUT.

MANUFACTURE

Power Bolt Cutters with Adjustable Dies and with Opening Dies for ¼ inch to 3½ inch diameter;

Hand, Machine Nut, Machine Screw, Pipe, Pulley and Stay Bolt Taps, Tapping Machines, Bolt Pointing Machines, Bit Brace Dies.

Screw Plates

For Cutting Threads on Bolts 1-16 in. to 1½ in. Diameter.

HAND BOLT CUTTERS

For ¼ in. to 1½ in. Diameter.

U. S. STANDARD THREAD GAUGES. DIAMOND POINT THREAD TOOLS AND CUTTING-OFF TOOLS FOR LATHES.

PRICE LIST and DISCOUNT SHEET furnished on Application.

THE BILLINGS & SPENCER CO., HARTFORD, CT., U. S. A.

—— MANUFACTURERS OF ——

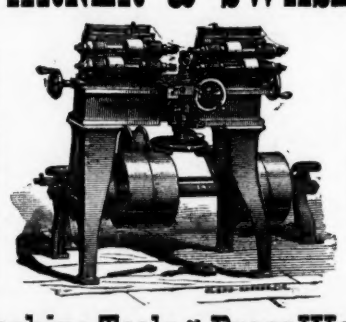
BILLINGS' TAP AND REAMER WRENCHES,

Drop Forged of Bar Steel. Three Sizes. A full line in Stock.

DROP FORGINGS OF EVERY DESCRIPTION.

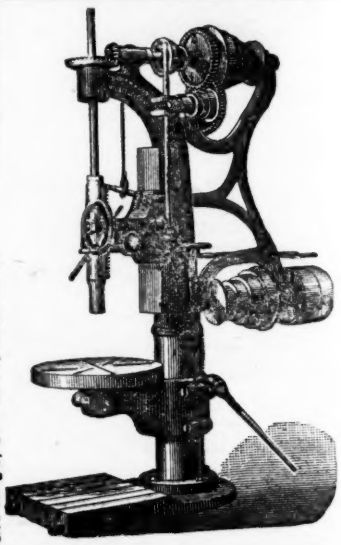
WARNER & SWASEY,

CLEVELAND, OHIO.



ILLUSTRATED CATALOGUE ON APPLICATION.

Machine Tools for Brass Work.



Engine Lathes, Planers, Drills, &c.
Successors to David W. Pond, Pond Machine Tool Co.
New Designs, Quick Delivery, Great Variety. WORCESTER, MASS.

GEO. W. FIFIELD,

MANUFACTURER OF

ENGINE LATHES

FROM 16 to 48 IN. SWING.

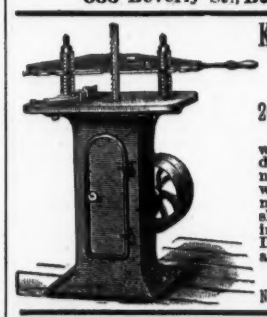
Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.

GEAR WHEELS AND GEAR CUTTING.
Send for Catalogue D.

G. B. GRANT,

666 Beverly St., Boston, Mass.



KEY-SEATING MACHINES AND 20-in. Drills a Specialty,

Our Key-Seating Machine will save enough in 60 days' use to pay first cost; no shop can afford to do without one. We have now ready for prompt shipment, both Key-Seating Machines and 20-inch Drills. Send for Photo. and Catalogue.

W. P. DAVIS,
NORTH BLOOMFIELD, N. Y.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

HARTFORD, CONN.

J. M. ALLEN, PRESIDENT.

W. B. FRANKLIN, VICE-PRESIDENT.

J. B. PIERCE, SECRETARY.

For New Reduced Price List, Write to

G. A. GRAY, JR., & CO.

42 E. 8th St., CINCINNATI, O

Lathes, 17 in. 20 in.

Planers, 24″x24′ 30″x20′

THE BUFFALO STEEL FOUNDRY, BUFFALO, N. Y.

ORDERS AND CORRESPONDENCE SOLICITED.

PRATT & LETCHWORTH Proprietors.

The Stiles Machinist Tool Grinder.

FOR GRINDING LATHE, PLANER AND OTHER TOOLS,

—MANUFACTURED BY—

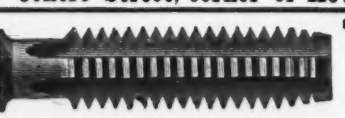
THE STILES & PARKER PRESS CO.

MIDDLETOWN, CONN.

Branch Works and Office:

203, 205, 207 Centre Street, corner of Howard, New York.

J. M. CARPENTER
PAWTUCKET, R. I.



Manufacturer —of— TAPS AND DIES